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PREFACE

THE term "Microlepidoptera" is commonly and loosely applied to the (usually small) moths belonging to the groups Pterophorina, Tortricina, Tineina and Micropterygina. Strictly speaking, many comparatively large moths of the families Cossidæ, Ægeriadæ, Hepialidæ, etc., should be included amongst the "Micros," numerous species of which, by the way, are considerably larger than many Macros, but, as Mr. Meyrick has recently remarked, some families of the true Microlepidoptera are commonly appropriated by the collectors of the larger Lepidoptera without any justification. For the purpose of these papers the term Microlepidoptera is taken to include those families which are not included in the volumes on Moths in the *Fauna of British India* series.

It is only within the last fifteen years that any serious attempt has been made to acquire a knowledge of the Microlepidoptera of the Indian Region. In 1889, at the time of the publication of Cotes' and Swinhoe's *Catalogue of the Moths of India*, only 225 species of Microlepidoptera were enumerated and this number included several synonyms and species which are not true "Micros." At the present time 2,422 species, contained in about 458 genera, have been recorded and we are still only beginning to learn what forms actually exist within the Indian Empire, in which enormous areas are still absolutely unknown so far as concerns their microlepidopterous fauna.

Our knowledge of the early stages of these little moths is still more incomplete, although numerous species are of considerable importance as pests of crops or of household or stored products. The Pink Bollworm (*Platyedra gossypiella*) and the Potato Moth (*Phthorimæa operculella*), for example, do damage which totals

many millions of rupees annually, whilst every household in India suffers loss on account of the Grain Moth (*Sitotroga cerealella*), and what housewife, be she never so careful, but has found reason to bewail the damage caused by Clothes Moths (*Tinea pellionella*, *Trichophaga abruptella*, etc.) ?

The present and subsequent papers endeavour to indicate our present state of knowledge (I might almost better say our want of knowledge) of the life-histories of these small moths, so far as they are at present known in India, and some indications are given of the early stages of three hundred and ninety-six species, the information given being based upon records already published in various sources and on unpublished records derived from the files of the Entomological Section of the Pusa Research Institute. The scattered manner in which these records have been published hitherto is indicated by the references given under each species and it is hopeless to expect the ordinary worker in India, without a veritable library specially gathered to this end, to be able to consult all these references at first-hand. I have therefore considered it better to bring together all the published information, even at the risk of a certain amount of repetition.

It is hoped that these papers will be of use, not only to the Entomological Staffs of the Agricultural Department who are interested primarily in crop-pests, but also to those collectors in India who ordinarily occupy themselves only with the butterflies and larger moths, mainly because of the scanty available information regarding the smaller forms.

It should be emphasized that these papers deal only with life-histories and not with control measures, in the case of pests or with classification. Both of these aspects may perhaps be treated of hereafter.

PUSA: T. BAINBRIGGE FLETCHER,
25th June, 1919. *Imperial Entomologist.*

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LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA.

I. PTEROPHORIDÆ.

BY

T. BAINBRIGGE FLETCHER, R.N., F.L.S., F.E.S., F.Z.S.,
Imperial Entomologist.

[Received for publication on 27th June, 1919.]

DIACROTRICHA FASCIOLA, ZELL.

Diacrotricha fasciola, Zeller, Linn. Ent., VI, 399 (1852) (1); Meyr., T. E. S. 1907, 471 (1908) (2); Fletcher, Spolia Zeylan., VI, 31-32, t. A f. 6, t. F ff. 5, 6, 8 (3).

Diacrotricha callimeres (Meyr., *ined.*), Lefroy, Ind. Ins. Life, p. 528 (1909) (4).

ORIGINALLY described from Java (1), this species is known to occur in India (2—4), Ceylon (2, 3) and the Kei Islands (New Guinea) (2). We have it from Galle (Ceylon), Gauhati and Pusa. It is probably widely distributed in India but has been overlooked.

"Bred by Mr. H. Maxwell-Lefroy from pupæ found on leaf of *Averrhoa bilimbi ?*, a tree of cultivation, so that it may be artificially spread" (2). These specimens were bred at Pusa from *Averrhoa carambola.*

"The short, stout, uniformly-coloured larva feeds on the flowers of the 'bilimbi tree' (*Averrhoa bilimbi*). The larvæ vary much in colour, hardly two being alike. Uniform yellowish-grey, pale yellow, pale greenish-yellow, pale green, pale pink, and red, are all common colours. (Plate F, figures 5 and 6)" (3). The young larva bores into flowers of *A. carambola* at Pusa, the hole of entry being visible on the side of the unexpanded flower.

"The pupa is a very pretty object, being usually a bright light green (sometimes with black markings) with numerous fasciculated tufts of yellow spiny hairs. The sketch (Plate F, figure 8) .... gives a good idea of its general

appearance. It is generally attached to a flower-stalk, but sometimes to a flower-petal or fruit, or more rarely a leaf, of the foodplant" (3).

"The transformations of this species are unusually rapid, the larva suspending itself and pupating in a few hours, the imago emerging after a pupal period of only four or five days" (3).

BUCKLERIA PALUDICOLA, FLETCHER.

Trichoptilus paludicola, Fletcher, Spolia Zeylan., V, 20-32, 7 figures (1907) (1) *l.c.* VI, 31, t. A f. 7 (1910) (2).

This species was originally described from Diyatalawa (Ceylon) (1) and has also been recorded from Madulsima (2) and the Khasi Hills (1). It is probably widely distributed in India in localities where *Drosera* grows but is inconspicuous and easily overlooked. We have it from Diyatalawa and Kegalle in Ceylon, and from Shillong.

At Diyatalawa the larva was found to feed on *Drosera burmanni*, which is of common occurrence in India also.

"*Egg-laying.* A female moth confined over plants of *Drosera burmanni* laid several ova, most of which were deposited on the seed capsules and unexpanded flower-buds. One ovum was laid midway on a petiole on the edge of a young leaf.

"*Ovum.* When first deposited the egg is of a pale shining green colour, showing prismatic tints. There seems to be a system of rather coarse reticulation disposed regularly over the surface, but the enclosed depressions are very shallow. It is oval in longitudinal, circular in transverse, section. Its length is about 0·45 mm. and its diameter about 0·18 mm.

"*Larva.* There are apparently four instars :—

"*First instar.* The newly-hatched larva is about 1 mm. long. In colour it is a pale transparent yellow which takes a reflected tint from the *Drosera* leaves, thus making the young larva very difficult to see; the prothoracic segment is a little darker, and the head is brown and comparatively very large. Scattered over the body are short white hairs, but they are neither conspicuous nor plentiful. No warts are visible.

"The larva crawls about without hesitation amongst the glandular hairs of the *Drosera* leaf, the gummy tips of the petioles standing up above it, so that it can walk about among their bases with impunity. In this stage it seems to feed entirely on the petioles and gum.

"Before undergoing its first ecdysis the larva grows to about 1·5 mm. in length, and the segmental interstices are more plainly marked in a lighter

yellowish colour, whereas the segments themselves have become of a darker greenish-yellow.

"*Second instar*. About 2 mm. long and rather stout. Colour a greenish-yellow, paler below and on the sides on which the spiracles stand out darkly; there are apparently small latero-dorsal tubercles which bear rather long white clubbed hairs.

"If feeds on the glandular petioles, biting through the base and drawing the stalk into its mouth by a series of movements and finishing by devouring the drop of gum. It seems fairly voracious, but is evidently rather fastidious in its selection of the glandular hairs.

"*Third (? antepenultimate) instar.* About 3 mm. long and fairly stout. Colour a pale green with interrupted pinkish latero-dorsal, lateral and supra-spiracular stripes. Tubercles green at base, brownish at points of emission of the white hairs . . . .

"*Fourth (ultimate) instar*. A fully-fed larva on the point of pupation is just over 7 mm. long, moderately stout, stoutest about middle of body, tapering rather more rapidly towards the head. Colour pale green, a dark rather reddish narrow medio-dorsal stripe; latero-dorsal tubercles red and surrounded with dark red dashes, which assume a rather longitudinal direction, so that the larva seems to have an interrupted rather broad latero-dorsal stripe. Head pale green with dark ocellar marks on either side. Jaws and mouth-parts reddish. Long palps on either side of jaws.

"The larvæ, however, vary much, but seem divisible into three types :—

"(1) Pale green with a distinctly reddish tinge; a narrow darker green dorsal stripe bordered on either side by a pale yellowish longitudinal line; head pale green with dark reddish ocellar patches; tubercles reddish-brown; hairs white, as long as diameter of segmental interstices, slightly and regularly dilated towards apex; prolegs pale green, almost transparent.

"(2) Paler green, on which the tubercles show up conspicuously as a bright dark red.

"(3) Very much suffused with red, so as to appear of almost as red a colour as the *Drosera* itself.

"The intensity of the dorsal stripe is very variable; in some specimens it is very distinct, in others quite obsolete.

"In its final instar the larva shows a decided preference for the buds and seeds of the *Drosera*, eating a hole in the side of the seed capsule and devouring the contents, but it also eats the leaves.

"*General remarks on the larval state*. In all its stages the larva is extremely similar to the *Drosera* and difficult to distinguish. Even a full-grown larva

may easily be passed over as a glandular leaf seen edgewise, and *vice versâ*.

"Ordinarily the larva seems sluggish, but can move along fairly fast when it likes. It has, indeed, little incentive to move from the foodplant. When resting across the centre of the plant, with plenty of food within reach, it seems to remain there for days, until a large pile of flaccid dark yellowish-green frass accumulates.

"In some cases the frass is jerked away by a rapid movement of the anal extremity. In one instance which I noted it went about an inch up into the air and fell on to the *Drosera* plant about half an inch away from the larva; but usually, I should imagine, it falls clear of the foodplant, or there would be no object in flicking it away in this manner. However, as noted above, the frass often does accumulate on the foodplant, so evidently this process of removal is not an invariable habit, but is a peculiarity confined to certain individuals.

"When crawling onto a *Drosera* plant the larva seems very careful to keep clear of the gummy detioles, and is assisted to do so by its long hairs, more especially those situated upon the head, for these hairs are seen to have enlarged basal attachments, which are evidently correlated with hypertrophied tactile nerves.

"When crawling over the leaves the gum is often seen to adhere to the legs of the larva, which then stops, bends down its head, and cleans them by passing the gummy legs through its mouth. The whole process rather reminds one of a cat licking itself clean.

"*Pupation.* When searching for the larvæ I must have examined several scores of *Drosera* plants, which either contained full-fed larvæ or showed signs of having recently done so, but only in one case have I as yet found the pupa in a natural position, and, judging by the restless behaviour of larvæ in confinement just prior to pupation, I am constrained to believe that the larva wanders away from the plant and fixes itself up for pupation on some grass stem or similar object, where its discovery would be rendered exceedingly difficult by its resemblance to a pendulous grass seed.

"This pupa, which was found *in situ* in its natural position (on 27th August) was on a medium-sized *Drosera* plant, which was growing under the shade of a tuft of grass. The plant had evidently been badly eaten by the larva, and there was no flower-stalk. The pupa was attached by its cremastral hooks to a silken pad spun on the base of a leaf just below the central bud and was lying, dorsal surface uppermost, across some leaves whose gummy

petioles had been eaten away by the larva. This pupa was of a greenish-yellow-brown colour, just the tint of the faded sundew leaves, and it looked rather like a grass seed which had fallen on to the plant and stuck to the gum; it may be added that ripe grass seeds are often so found.

"In confinement the larva exhibits a certain preference for suspension from the flower-stalk of its foodplant, whose colour is of a reddish green. Even when the stem is growing at an angle, its double set of cremastral hooks enables the pupa to keep its ventral surface closely appressed to the lower side of the stem, so that it is not suspended freely. It seems possible that this pupa possesses a certain amount of colour adaptability, those pupæ attached to the reddish flower-stems having usually an increased red suffusion in comparison with those attached to glass or white paper.

"When on an approximately horizontal surface, the pupa is usually found dorsum uppermost; otherwise it invariably suspends itself head downwards and with the ventral surface appressed to its support.

"In the case of a pupa in a horizontal position the cast larval skin is sometimes seen lying near it, but quite free and shrivelled up. The suspended pupa always gets rid of the larval skin entirely. This habit is the exact opposite of that found in *Trichoptilus oxydactylus* [*Buckleria defectalis*], whose discarded larval skin is not shrivelled up, but is stretched out along the stem just above the pupa.

"When first formed the pupa is of a light apple-green colour, the wing-covers and appendages of a darker green, and a narrow darker medio-dorsal stripe. On either side of this last is a series of eight red tubercles, each bearing two black spines, both pointing longitudinally in opposite directions; on about the eighth somite, however, the foremost of these two spines becomes obsolescent and quite disappears before the anal extremity is reached. The cremaster consists of two portions approximately equal to one another, one in the centre of the ventral surface of the twelfth somite, the other at the anal extremity.

"In some cases the newly-formed pupa is wholly suffused with a delicate pink flush, which almost becomes a dull red in some specimens.

"After a couple of days the bright green begins to fade and ultimately becomes a dull uniform pale yellowish-brown, by which time the eyes and antennæ are clearly marked in black.

"The pupa is formed about thirty hours after the larva has suspended itself, and the moth emerges after about nine or ten days in the pupal state.

"The moth always emerges in the morning, usually at about 8 A.M" (1)......

BUCKLERIA XERODES, MEYR.

Trichoptilus xerodes, Meyr., T. E. S., 1886, 14 (1), *l.c.* 1885, 422 (2), *l.c.* 1887, 267 (3), B. J., XVII, 134 (1906) (4); Fletcher, Spolia Zeylan., VI, 30, t. A f. 9, t. F f. 4 (1909) (5); Meyr., Gen. Ins. Pteroph., p. 5, tab. f 2 (1910) (6).

This species is widely distributed throughout Australia (1—3) and has also been recorded from New Guinea(6) and Ceylon(5). We have it from Nagpur, where it was reared by Ratiram Khamparia on 22nd November, 1912, from a larva found on pods of *Cajanus indicus*, from Khurda, Pollibetta (Coorg), and from Trincomali and Haldummulla in Ceylon.

A larva found at Peradeniya on 26th December, 1907, on *Gynandropsis* sp. (Capparideæ) was described as "about 12 mm. long, cylindrical, moderately stout. Head yellowish with an orange tinge. Colour of other segments a uniform pale yellow. A large brown latero-dorsal wart emits a long white hair and about five short ones. Below this is a small black supraspiracular tubercle emitting a single short white hair and bearing a short secondary hair. Spiracle small, black. A small black subspiracular tubercle emits (1) a short white hair directed forwards and downwards, (2) a longer white hair directed backwards and downwards. Below this and a little behind it is a small black wart emitting a single hair. Towards the ventral surface are two (? three) small black warts emitting white hairs. There are numerous small knobbed white secondary hairs. All warts are well raised above the surface of the skin, and the divisions of the segments are well marked. (Plate F, figure 4)."(5) This larva was not reared and at the time was only supposed to be *B. xerodes* but later on Mr. Green informed me that he had bred this species from similar larvæ on this foodplant.

BUCKLERIA DEFECTALIS, WLK. (PLATE I, FIG. 1.)

Pterophorus defectalis, Wlk., Cat. XXX, 943 (1864)(1).
Pterophorus congrualis, Wlk., Cat. XXX, 943 (1864)(2).
Pterophorus oxydactylus, Wlk., Cat. XXX, 944 (1864)(3).
Trichoptilus ochrodactylus, Fish, Canad. Ent. XIII, 142 (1881)(4); Fernald, Pteroph. N. Amer., 2nd edit., p. 15 (1898)(5).
Trichoptilus compsochares, Meyr., T. E. S., 1886, 16 (1886)(6).
Trichoptilus centetes, Meyr., T. E. S., 1886, 16-17 (1886)(7), *id.*, *l.c.* 1887, 266 (1887)(8); Wlsm., P. Z. S., 1891, 494(9), *id.*, *l.c.* (1897), 56(10).
Trichoptilus ralumensis, Pag., Zoologica, XXIX, 239(11).
Aciptilia oxydactyla, Wlsm. P. Z. S., 1885, 885(12), Moore, Lep. Ceylon, III, 529, t. 209, f. 16(13).

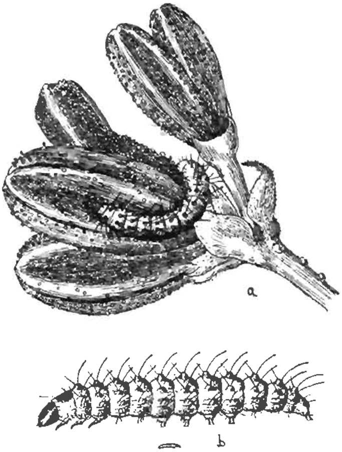


Fig. 1. *Buckleria defectalis*:—*a*. Larva feeding on fruits of *Boerhaavia repens* (x 10); *b*, larva, about half-grown, natural size and magnified (x 13).

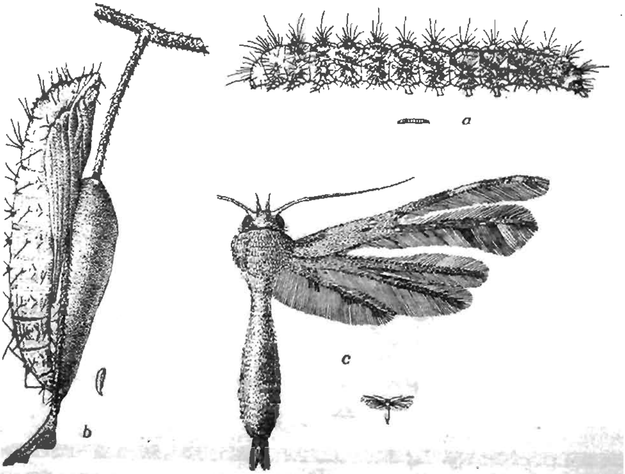


Fig. 2. *Buckleria wahlbergi*:—*a*, Larva; *b*, pupa; and *c*, moth, natural sizes and magnified (x 11).

Trichoptilus congrualis, Fletcher, Spolia Zeylan., VI, 28-30, t. A f. 8, t. F ff. 2, 3 (1909)([14]).

Trichoptilus defectalis, Fletcher, T. L. S. (2) XIII, 312 (1909)([15]).

Buckleria defectalis, Fletcher, T. L. S. (2) XIII, 398-399 (1910)([16]).

Originally described from West Africa([1]) and Ceylon ([2, 3]), this is an extremely widely distributed species, recorded from the Southern United States, West Indies, Peru, West, South and East Africa, Mauritius, Farquhar Island, Amirantes, Coetivy, Seychelles, Chagos Islands, Ceylon, India, Formosa, China, New Guinea, North-East Australia and Hawaii([10]).

In India and Ceylon this seems to be a Plains species, found abundantly in all sandy areas where its foodplant, *Boerhaavia*, occurs. We have specimens from Trincomali, Colombo, Coimbatore, Pusa, Chapra, Bassein Fort (Bombay), Lyallpur, Peshawar, and Hangu (Kurram Valley).

The following description was made from a larva found at Galle on 10th May, 1907 :—"The larva has just cast its skin (which remains alongside it, uneaten) and is probably just commencing its final instar. Length 5·5 mm. Breadth in thickest part (about middle) 1·5 mm. Hairs about 1 mm. long. In shape it is cylindrical, moderately stout, tapering at either extremity. When crawling, the thoracic segments, especially the prothoracic, are greatly extended and appear very slender and flattened. The head appears to be uniformly jetty-black, but under a high-power lens the central portion and jaws are seen to be yellowish with a few short yellowish hairs. The ground-colour along the side is a pale yellowish shade of dirty grey with a tinge of red (this last colour is more pronounced in some specimens). There is a narrow medio-dorsal stripe of a shade rather darker than the ground-colour and a little redder. On the metathoracic segment the two warts edging the medio-dorsal line are faintly marked with dark reddish-fuscous ; the four succeeding segments have these warts distinctly marked with the same dark reddish-fuscous, and therefore show up like spots. (In other larvæ all the dorsal warts are more or less marked with dark fuscous, shading off at either extremity of the larva.) A broad but indistinct fuscous subspiracular line. A rather broad ventral pale-greenish stripe. The prolegs are very long and slender and are of a pale greyish greenish-yellow, the hooks dark ; the legs are similarly coloured. The long hairs appear dark but there are numerous minute white knobbed glandular secondary hairs scattered over the segments, and these appear to secrete a viscous fluid"([14]).

Two full-fed larvæ found at Colombo on 18th October, 1907, were described as "stout, stoutest about fourth segment, decreasing thence rapidly towards the head, anally gradually. Colour a pale yellow with a faint tinge of fuscous

green. There is a broad dull reddish longitudinal spiracular stripe, on which the spiracles stand out as pale longitudinal blotches. The medio-dorsal stripe has a faint tinge of red in it, making it a little darker than the ground-colour. On either side of this, bordering the darker brown latero-dorsal tubercles, is a series of whitish longitudinal dashes, forming two interrupted dorsal lines—these markings absent in one larva. Head dark brown. The long hairs are black and obviously sticky. A younger larva, about half-grown, is dark brown without any obvious markings, the hairs very distinctly clubbed at the apex."

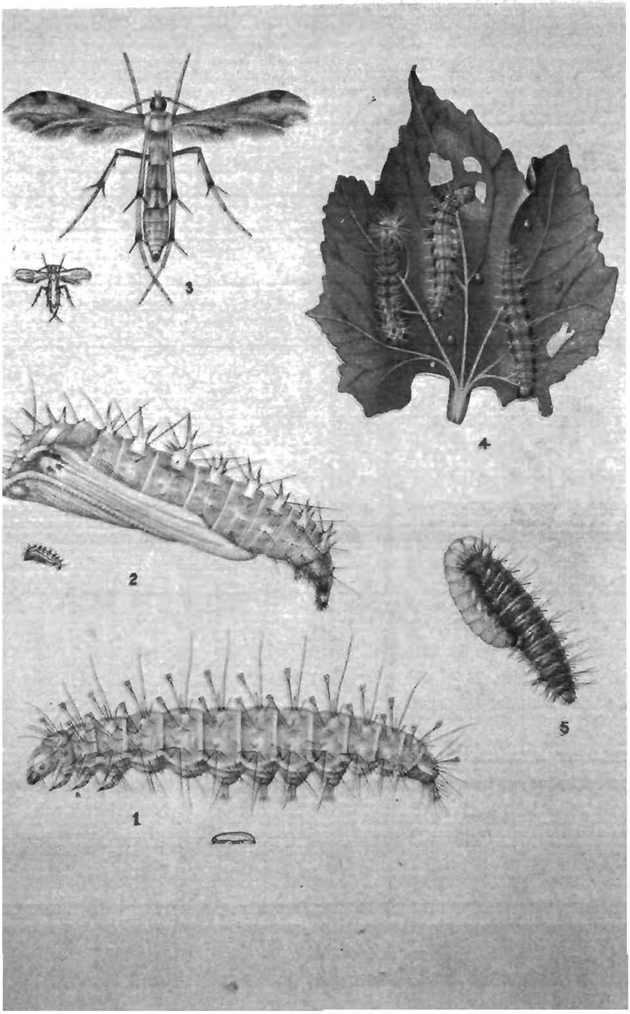
"The larva is generally rather sluggish but can be quite active, *e.g.*, if searching for food. If it loses its foothold, it drops by a silken thread. It feeds on the unripe seeds of *Boerhaavia repens*, commencing by eating the viscid exudation on the outside of the perianth tube, through which it then gnaws a hole and excavates the contents. Small insects, especially ants, are often seen to be caught by this gummy secretion, but the gum does not seem to incommode the larvæ at all; probably their extremely long prolegs are specially modified to carry them over it without touching it as they walk, and the long larval hairs prevent contact of the body with neighbouring drops of gum "(14).

"The larva seems to pupate almost invariably on the slender stem just below a seed-head, although I have once found an empty pupa-case attached to the mid-rib on the under-surface of a small leaf. The pupa hangs freely suspended, the discarded larval skin not being shrivelled up but stretched out at full length along the stem just above it. The rain soon destroys the empty pupa-cases and one finds only the anal portion with the discarded larval skin. The colour of the pupa is very variable; sometimes it is a light apple-green, sometimes a brownish-grey "(14).

BUCKLERIA WAHLBERGI, ZELL. (PLATE I, FIG. 2.)

Pterophorus wahlbergi, Zell., Linn. Ent. VI, 346 (1852)(1).
Pterophorus rutilalis, Wlk., Cat. XXX, 943 (1864)(2).
Trichoptilus pyrrhodes, Meyr., Proc. Linn. Soc. N.S. Wales (2) IV, 1113 (1889)(3).
Trichoptilus wahlbergi, Meyr., B. J., XVII, 134 (1906)(4); Fletcher, Spolia Zeylan, VI, 27-28, t. A f. 10 (1909)(5).
Buckleria wahlbergi, Fletcher, T. L. S. (2) XIII, 399, f. 2 (1910)(6).

This is a widely distributed species recorded from South Africa, St. Helena, Seychelles, India, Ceylon and Queensland(6). It is common throughout India and Ceylon and we have it from Kandy, Haldummulla and Madulsima



3
4
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1

EXPLANATION OF PLATE II.

SPHENARCHES CAFFER.

Fig. 1. Larva, natural size and magnified.
,, 2. Pupa, natural size and magnified.
,, 3. Moth, natural size and magnified.
,, 4. Eggs and larva on leaf, showing colour variation in larva.
,, 5. Larva attacked by a Hymenopterous parasite.

(Ceylon), Palni Hills, Shevaroys, Coimbatore, Bangalore, Mercara, Pollihetta, Sidapur, Pusa, Shillong, Bhim Tal, Abbottabad, Peshawar and Parachinar.

The egg has been described as "of a smooth elongate-oval shape and of a very pale shining greenish-white colour. In size it is about 0·47 mm. long by about 0·32 mm. broad and 0·28 mm. high, a transverse section thus being oval. The newly-hatched larva is whitish, with a black head and long black dorsal hairs "(5).

The full-grown larva is about 6·5 mm. long and about 1·25 mm. broad, cylindrical, slightly tapering towards either extremity, segments distinct, pale yellow slightly tinged with greenish; head pale yellow with some faint pinkish blotches and bearing longish hairs, these hairs especially evident on the front and some of them being knobbed apically; other segments with a distinct pinkish-brown mid-dorsal stripe and with interrupted lateral stripes, ventral area pale greenish-yellow; tubercles rather protuberant, each bearing a tuft of hairs of different lengths, the post-spiracular tubercle only having a single hair; short secondary hairs scattered over segments; spiracles protuberant, tubular; five pairs of equally developed, rather long, pale yellow prolegs. The larva feeds upon *Oxalis* sp., pupation taking place upon a leaf of the foodplant. The pupa is pale apple-green with whitish hairs as shown in figure.

SPHENARCHES CAFFER, ZELL. (PLATE II.)

Oxyptilus caffer, Zeller, Linn. Ent. VI, 348-349 (1852) (1).

Sphenarches caffer, Wlsm., Ind. Mus. Notes, II, 20 figs. (2); Cotes, *l.c.*, p. 163 (3); Meyr., Fauna Geogr. Maldives, I, ii. 125(4); Lefroy, Ent. Mem., I, 220(5); Fletcher, Spolia Zeylan., VI, 21-22, t. E ff. 8, 10, t.F f.11 (1909)(6); Lefroy, Ind. Ins. Life, p. 528, f.343 (1909)(7); Fletcher, T. L. S. (2) XIII, 399 (1910)(8), South Ind. Ins., pp. 443-444, f.320 (1914)(9), Proc. Second Entl. Meeting, pp. 44, 56, 306 (tab.) (1917)(10).

Oxyptilus anisodactylus, Wlk., Cat. XXX, 934 (1864)(11); Moore, Lep. Ceylon III, 528(12).

Pterophorus diffusalis, Wlk., Cat. XXX, 945 (1864)(13).

Oxyptilus walkeri, Wlsm., T. E. S. 1881, 279-280 (1881)(14).

Sphenarches synophrys, Meyr., T. E. S. 1886, 17-18 (1886)(15).

This is a remarkably widely-distributed species ranging through the whole of West, South and East Africa, the Seychelles and Maldive Islands, Ceylon, throughout India, Burma, the Philippines, Japan, Sumatra, Java, throughout Australia, New Hebrides, Tonga Islands, and the West Indies. This distribution has perhaps been caused to some extent by human agency.

Life-history. The egg is oval, cylindrical in section, and measures about 0·5 mm. in length. It appears smooth, though the outer surface is actually reticulate; the colour is an indefinite bluish-green, becoming yellow before hatching. Eggs are laid in spots determined by the ability of the moth to assume a position of rest; they never rest on the upper surface of a horizontal leaf but can rest on the lower surface of a leaf or place at any angle from the perpendicular to the horizontal; they appear always to hang from an object rather than rest on it; on the broad leaves of cucurbitaceous plants, eggs are laid on the lower surface; on the alternative foodplant, pigeon-pea, they are laid on the flower-buds and young pods. Eggs are usually laid singly, often only one on a pod or flower-bud, several on a young leaf. In the Insectary, 193 eggs were laid by two moths, all being laid at night. The eggs hatch in two days in warm weather up to six days in the colder weather of the North Indian winter:—

Eggs laid	Eggs hatched	Duration
7th September	9th September	2 days.
8th "	11th "	3 "
9th "	12th "	3 "
16th "	19th "	3 "
9th February	15th February	6 "

The larva emerges from the egg by biting away a small portion and then pushing through. The empty egg-shell is not eaten. On hatching the larva is about a millimetre long; the head is dark brown and shiny; there is a distinct prothoracic shield; the segments are well marked and on each segment there are five tubercles bearing from one to three hairs each; these tubercles are regularly arranged and form rows along the body; the round spiracle lies between the second and third tubercles. There are three pairs of thoracic legs and five pairs of prolegs.

The larva is of a yellowish-green colour on hatching, becoming green as it grows older and remaining of that colour; on the pods of pigeon-pea, which are coloured usually in green with brown stripes, the larva also has a lateral brown stripe and assimilates very closely to the colour of the pod; on green leaves of pumpkin, etc., it is green and this assimilates it to the pure green of the leaf. The larva alters little in appearance, during the various instars; in the last instar the dorsal three black tubercles are developed into more prominent protuberances; the first and third are yellow, the second black, each with

white hairs. There are also capitate smaller hairs on the upper part of each segment.

The *larva, about half-grown, was described as "Head yellow. Other* segments pale brownish-yellow. A narrow dorsal, latero-dorsal, and spiracular reddish stripe. Legs pale yellow, prolegs and claspers dark. Hairs white, except the short clubbed hairs which are black "(6).

The full-grown larva "is about 7 mm. long, cylindrical, rather stout, the segmental interstices well marked. Legs and prolegs long and slender; pale greenish-yellow. Head unicolorous, very pale, transparent greenish-yellow; mouth-parts darker. Other segments pale greenish-yellow; a narrow darker green dorsal line; each segment with a large but ill-defined, pinkish-red, latero-dorsal spot, the series of these spots forming an interrupted longitudinal line. Two conjoined latero-dorsal tubercles emit a very long white hair directed upwards and a shorter white palmate hair directed upwards and forwards; a supraspiracular tubercle emits a brown palmate hair directed upwards and forwards; two conjoined subspiracular tubercles emit a short white hair directed forward and a long white hair directed downward; there are also one or two latero-ventral tubercles emitting white hairs. The whole surface of the segments is also closely studded with short white clubbed secondary hairs "(6).

The larvæ feed on the leaves of pumpkin, eating small holes in them and not feeding in from the margin. In the case of pigeon-pea and other pulses, the larva eats into the flower-buds and pods, but never goes fully inside. The clothing of spines and hairs probably serves a protective purpose, since this larva feeds on hairy leaves and pods and is both in colouring and pilosity assimilated to the surface it is on; it is sluggish in movement and clings tightly where it is openly exposed upon the leaf or pod.

Pupa. Pupation takes place as follows:—The fullgrown larva spins silk upon the leaf or pod over a surface about 10 mm. by 8 mm. and then rests upon this, the anal prolegs firmly fixed in the end of it. The skin splits in front, and slips backwards along the body; on the underside of the eighth abdominal segment is a distinct bunch of curved hooks (cremastral pad), which engages in the silk as the larva wriggles; the hind end is then freed from the larval skin and the bunch of stiff recurved hairs on the eighth segment acting as a fixed point, the anal end by wriggling fixes the terminal bunch of hooks in the silk. The pupa is thus fastened by two points; its anterior half is free and can be raised till it is almost at right angles to the fixed abdomen.

"The pupa is about 7 mm. long and is attached to the undersurface of the mid-rib of a leaf of the foodplant. The appendage sheaths and anal portion are of a yellowish-green colour, the remainder of a very pale pinkish-red. The dorsal surface bears a system of highly specialized tubercles, the nature of which will be best undertstood by a reference to the figure (Plate F, figure 11)"(6).

The moth is shown in Plate II. figure 3. It measures 6·8 mm. and has a wing expanse of 13-15 mm. The wings are held out at right angles to the body when at rest. The moths are to some extent diurnal and fly by day; coupling takes place by day or night and lasts about 12 hours.

Duration of life-cycle. The winter life-cycle is longer than that of the hot weather or rains; it occupies nearly two months:

Egg ..	6 days.
Larva ..	30 ,,
Pupa ..	22 ,,
TOTAL ..	58 ,,

In February-March, it is:

Egg	6 days
Larva ..	20–21 ,,
Pupa ..	9 ,,
TOTAL ..	35–36 ,,

In September, it is:

Egg ..	2 days
Larva ..	17–20 ,,
Pupa ..	5 ,,
TOTAL ..	24–27 ,,

Occurrence. This insect may be found in active life throughout the year; there appears to be no definite stage in which it rests or hibernates, and the broods succeed one another irregularly from month to month. In the cold weather, as in the hot weather and rains, the larvæ are found on the different foodplants; these include the pigeon-pea (*Cajanus indicus*), *kulthi* (*Dolichos lablab*), the *kaddu* or bottle-gourd (*Lagenaria vulgaris*); the plant known as calabash is also stated to be the foodplant in West Africa. They are most noticeable on the flower-buds and pods of pigeon-pea in the early or late cold weather, since they are then associated with damage to this crop, caused also by ***Exelastis atomosa***, **Wlsm. It is uncertain how long the moth can live; in**

captivity they dic in a week or less, but this is no guide since they are not in normal conditions. Actually there are probably always available foodplants in India ; cultivated or wild forms of this gourd are grown constantly and in great profusion ; the pigeon-pea and lablab bean are cxtensively grown over India. Besides *Dolichos* and *Cajanus*, the larva of *S. caffer* has been found feeding on *Averrhoa bilimbi* (*bilimbi* tree), buds of *Luffa* sp., petals of *Hibiscus mutabilis*, *Biophytum sensitivum* and *Mimosa pudica* (sensitive plant), so that it is decidedly polyphagous and would apparently be able to hold its own in the absence of cultivated crops.

Practically nothing is on record regarding its distribution in India, but it seems to occur practically throughout India, Ceylon and Burma. The Pusa collection contains specimens from Madulsima, Haldummulla, Peradeniya, Coimbatore, Anamalais, Ootacamund, Pollibetta, Bababudins, Surat, Allahabad, Pusa, Bhim Tal, Sarai Saleh (Hazara), Peshawar, Shillong and Maymyo.

OXYPTILUS LACTUCÆ, n. sp.

Expanse 19 mm. Palpi porrect, second joint triangularly dilated with long scales, third joint long, slender ; ochreous, intermixed with white scales, third joint whitish above. Head tawny-ochreous. Antennæ blackish, white-ringed. Thorax tawny-ochreous, tegulæ ochreous. Legs whitish : posterior tibiæ broadly banded and dilated with reddish-brown scales at origin of spurs at 3/5 and apex ; spurs white, blackish apically, internal proximal spur longer than external and this latter longer than either of the equal distal pair ; posterior tarsi whitish, lined and banded with brown. (Abdomen broken.)

Forewing cleft from slightly beyond ½ : first segment parallel-sided, narrow, rather falcate apically ; second segment broadening posteriorly, apex produced, strongly falcate, anal angle well marked, termen concave : ochreous-tawny, irrorated with whitish and black scales ; an ill-defined whitish patch at base of cleft, tending to form a bar to costa ; first segment with narrow white bars at 2/5 and ¾ of length, these bars continued on to second segment. Cilia on costa broadly whitish opposite white bars, whitish before apex ; on termen whitish with fine brown streaks from apex of either segment ; on posterior margin of first segment pale ochreous to first white bar, from this to 5/6 brownish intermixed with scattered black scales, from 5/6 to apex ochreous white ; on anterior margin of second segment ochreous-brown with a few white and black scales and a strong row of black scales between ½ and 5/6 of segment ; on dorsum ochreous-brown, at ½ a tuft of white scales, from about ¾ to slightly beyond first white bar on second segment whitish, beyond this

darker, with slight black scale-teeth at ½ and ¾ and wisps of blackish hairs at 5/6 and anal angle, this last followed by a white wisp.

Hindwing cleft from about 2/5 and 1/6: first segment narrow, parallel-sided, rather blunt at apex; second segment narrower than first, gradually narrowing to apex; third segment almost linear, narrower than second, narrowing to apex: tawny-brown, thickly irrorated with black. Cilia dark tawny brown, paler within clefts; posterior margin of second segment with an ill-defined whitish wisp beyond ½, third segment with a strong triangular black scale-tooth on dorsum at 2/3, between this and base dorsal area with a few scattered black and white scales, beyond this dorsal cilia faintly whitish basally.

Dehra Dun, October 1916 (*Ollenbach*). Bred from larvæ on lettuce. Three specimens, of which two are in poor condition.

This species is superficially much like a large, dark, strongly-marked *Sphenarches caffer*, from which it may easily be separated by the entire absence of black scales on the anterior margin of the third segment of the hindwing. It is possible that this species may be a *Sphenarches*, but I have been unable to determine satisfactorily the origin of vein 10 of the forewing.

OXYPTILUS EPIDECTES, MEYR.

Oxyptilus epidectes, Meyr., T. E. S. 1907, 476-477 (1908)(1); Fletcher, Spolia Zeylan, VI, 26, t. A f. 5 (1909) (2).

Originally described from Burma (Mon), Nilgiris, Coorg, Ceylon (Maskeliya) and Mauritius, this species is also known from Kandy and Madulsima and we have specimens from Madulsima and Haldummulla in Ceylon and from Pollibetta in South Coorg.

The moths have been bred from *Biophytum sensitivum*, which is evidently the foodplant(2).

OXYPTILUS CHORDITES, MEYR.

Oxyptilus chordites, Meyr., Exot. Micr., I, 106 (1913)(1).

Described from Colombo and Karwar(1).

Larva on *Calycopteris floribunda*(1).

OXYPTILUS PELECYNTES, MEYR.

Oxyptilus pelecyntes, Meyr., T. E. S. 1907, 477 (1908)(1).

This species was described from the Khasi Hills(1), where it is common, the larva feeding on *Scutellaria discolor*. We have it from Shillong and from Haldummulla (Ceylon).

OXYPTILUS CAUSODES, MEYR.

Oxyptilus causodes, Meyr., B. J., XVI. 582 (1905)(1); Fletcher, Spolia Zeylan., VI, 24-25, t. A f. 4, t. E f. 9 (1909)(2).

Originally described from Peradeniya(1, 2), this species also occurs in India and has been found at Pusa. The adult is, however, rarely seen, although easily bred from the larva which, in Ceylon, feeds inside the fleshy fruits of *Dillenia retusa*. In India it must have other foodplants, since, so far as I am aware, no species of *Dillenia* occurs at Pusa in the immediate vicinity of the locality where the adult moth has been taken.

"The full-grown larva (suspended for pupation) is about 13 mm. long by about 1·2 mm. broad, cylindrical, slender, shining, and appearing quite smooth and naked. There are two principal colour varieties, (1) wholly pale green without any noticeable markings except a narrow darker medio-dorsal stripe, and this is perhaps due to the vessels beneath showing through the skin rather than to any dermal pigmented area; towards the anal extremity a pinkish suffusion is seen along the segmental interstices, (2) very pale semi-transparent pinkish flesh-colour, interstices of segments very pale semi-transparent green, as are also some patches along the sub-median area of most of the segments, but the pale green and pink so merge into one another that no definite areas can be described. Head very pale green. A pale red medio-dorsal line. But some larvæ have no green markings, being wholly pink. The prolegs are very small and stumpy; hooks dark reddish. The hooks on the fourth pair of prolegs are attached into the silken pupation-pad. The arrangement of the tubercles is shown in the figure (Plate E, figure 9)"(2).

When full-fed the larva emerges from the fallen fruit "to suspend itself for pupation on any neighbouring object." "The larva pupates very rapidly; twelve hours is sufficient for it to emerge from the fruit, select a suitable place for pupation, suspend itself, and complete its metamorphosis."

"The newly-formed pupa is of a bright light green colour, the capital extremity tinged with yellowish-brown about the base of the antenna-sheath; but it soon becomes of an almost uniform reddish grey-brown. The moth, which usually seems to emerge early in the morning, appears after six days"(2).

XYROPTILA VAUGHANI, FLETCHER.

Oxyptilus vaughani, Fletcher, Spolia Zeylan., VI, 23-24 (1909)(1).

This species was described from Ceylon (Madulsima, Alutnuwara, Trincomali and Haldummulla). The early stages are as yet unknown, but the larva probably feeds inside the fruit of *Dimorphocalyx glabellus*(1), and the moth has been reared from a pupa found on a leaf of this shrub.

An egg, extruded by a captured female moth, was about 0·35 mm. long by 0·20 mm. broad, the ends rounded, uniform salmon-pink, the surface shining and covered with a series of large depressions.

DEUTEROCOPUS ALOPECODES, MEYR.

Deuterocopus alopecodes, Meyr., B. J., XXI, 105-106 (1911)(1).

Described from Karwar where the moths were found in August "from a single vine-plant on which the species was plentiful"(1). The larva presumably feeds on this vine, but this species is unknown to me.

DEUTEROCOPUS SOCOTRANUS, REBEL.

Deuterocopus socotranus, Rebel, Denk. Math-Nat. Ak. Wiss., LXXII, pt. ii, pp. 85-87, fig. (1907)(1); Fletcher, T. E. S., 1910, 124-130, ff. 3, 4, t. 44 f. 8, t. 45 f. 1(2).

Deuterocopus tengstrœmi (*nec* Zell.), Meyr., B. J., XVII, 134 (1906)(3).

Deuterocopus viticola, Meyr., B. J., XXI, 104-105 (1911)(4).

This species * is very widely distributed, its range extending from West Africa, S.E. and East Africa, Sokotra, through India, Ceylon, Sumba, Tambora and Amboyna to New Guinea and Queensland. In India, Ceylon and Burma it is common in most districts and we have it from Hambantota, Coimbatore, Surat, Pusa, Moulmein and Minbu. At Pusa it has been reared from larvæ on *Vitis trifolia.*

"The larva feeds in Ceylon on the flowers of the square-stemmed jungle vine (*Vitis quadrangularis*) . . . . . . The following is a brief description from a living larva found at Hambantota :—Length 7 mm., stout, stoutest at about mid-length, decreasing rapidly anally ; head capable of retraction into or under prothorax. Incisions between segments distinctly marked. Colour a uniform pale green ; head yellowish-brown and prothorax dark blackish-purple. Prothoracic legs purple, other legs and prolegs pale green ; legs and prolegs rather short and stout. To the naked eye no hairs are visible except two pairs of short whitish curved hairs on the anal segment and a pair of short submedian hairs, directed forward, on each thoracic segment. Spiracles high-placed, about half-way up the side, fairly conspicuous from being outlined in a slightly lighter green tint than that composing the general colour

* Mr. Meyrick(4) considers that the form described by me as *socotranus*(2) consists of heterogeneous material. The true *socotranus* is possibly truly distinct, as indicated in my paper on this genus, but examination of over one hundred specimens ranging from West Africa to New Guinea failed to provide me with any satisfactory method of separating these into true species, and I adhere to my former expression of opinion on this point. An almost exactly similar case is provided by *Buckleria defectalis*, Wlk.

of the larva. Movements slow and deliberate, spinning a thread as it moves along and when it drops. Under the microscope the skin is seen to be covered with minute skin-points as if shagreened "(2).

"The pupa is attached to a flower, flower-stalk or stem of the foodplant, or more rarely to a leaf of the same, and is usually enclosed in a very flimsy cocoon composed of a few silken threads. It is possible, however, that these threads are merely fortuitous, having been spun by the larva during its search for a suitable pupation-place or whilst preparing its cremastral pad. The pupa is about 6 mm. long, stout, smooth, rounded and blunt at the capital extremity. Its usual colour is a pale apple-green, marked with dark or pinkish-red on the dorsal surface, the markings usually consisting of (1) a narrow median thoracic stripe broadening posteriorly into a transverse bar extending obliquely downwards to about the edge of the wing-covers, and (2) a series of submedian patches on the second to fifth abdominal segments forming a more or less interrupted longitudinal stripe. Some pupæ, however, which had pupated in my boxes, were wholly of a dark-grey colour. The moth emerges in the early morning "(2).

DEUTEROCOPUS PLANETA, MEYR.

Deuterocopus planeta, Meyr., T. E. S., 1907, 473-474 (1908)(1); Fletcher, T. E. S., 1910, 131-134, f. 5, t. 44 f. 10, t. 45 f. 2 (1910)(2).

Deuterocopus rubrodactylus (*nec* Pag.), Fletcher, Spolia Zeylan., VI, 20, t. E f. 7 (1909)(3).

This species ranges from Ceylon, Khasi Hills and Burma to Portuguese Timor, Tenimber and New Guinea(2). We have it from the Bababudin Hills and Pollibetta (South Coorg).

"The egg is about 0·44 mm. long by about 0·20 mm. broad; in shape it is ovo-cylindrical, the ends rounded and subequal, the micropylar area distinctly depressed; the surface is very smooth and shining, of a very pale orange colour, suffused with red at either pole "(2).

The larva feeds on the flowers of *Leea sambucina* and is "pale green without any markings except red suffusion at either extremity. The skin is roughened into minute knobs (like shark skin) everywhere, but especially on the ventral region. A distinct subsegment is formed on the posterior ventral region of abdominal segments. The hairs, except (i), are very short and inconspicuous; (i) is short, less than breadth of segment. The hairs are transparent whitish (glassy) and the tubercles very indistinct. The hairs are longest on thoracic and anal regions. The legs are extremely short and inconspicuous. There are no secondary hairs, these seeming to be reduced

to skin-points or rather rugosites of the skin." A sketch showing the arrangement of the tubercles is given in *Spolia Zeylanica*, VI, t. E. f. 7.

The pupa is "brown with a broad lighter ochreous-fuscous central band; very few hairs or projections. It was suspended anally to a flower-stalk within a slight attempt at a cocoon—a few silken threads spun around it to form a spacious but flimsy enclosure, in which the pupa was fully visible. The cast larval skin remained at the anal extremity of the pupa "(2).

DEUTEROCOPUS RITSEMÆ, WLSM.

Deuterocopus ritsemæ, Wlsm., Notes Leyden Mus., VI, 243 (1884)(1); Fletcher, T. E. S., 1910, 134-138, f. 6, t. 44 ff. 11, 12 (1910)(2).

Deuteroscopus rubrodactylus, Pag., Abh. Ges. Zool., XXIX, 241(3).

This species occurs in Ceylon, Assam, Tenasserim, and from Borneo to New Guinea(2). We have specimens from Kandy and Pollibetta.

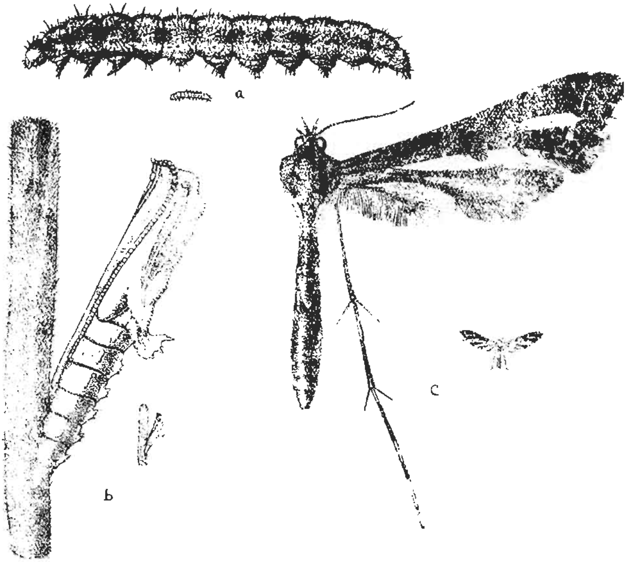
The early stages are as yet practically unknown. The moth has been bred by me in June 1908 at Galle from pupæ," found suspended anally from the upper surface of leaves of *Leea sambucina*, which is evidently the food-plant. The different method of suspension, as compared with the pupa of *D. planeta*, is noteworthy. On the same bush I found a larva feeding inside an unopened flower-bud; it appeared to be very similar to that of *planeta* but wanted the terminal red suffusion; unfortunately I failed to rear it "(2).

PLATYPTILIA CITROPLEURA, MEYR.

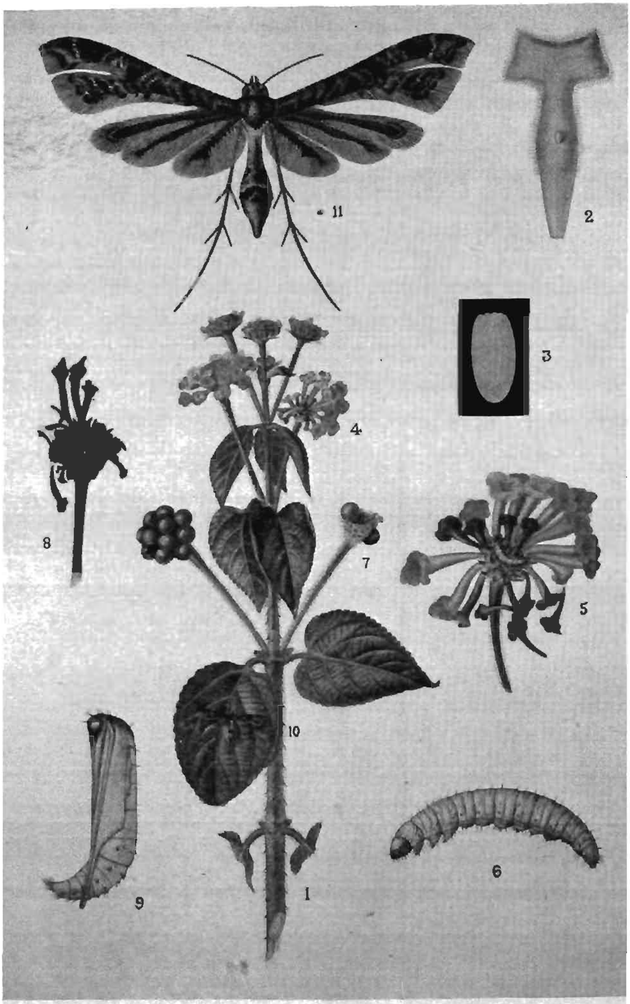
Platyptilia citropleura, Meyr., T. E. S., 1907, 482 (1908)(1); Fletcher, Spol. Zeylan., VI, 15 (1909)(2); Meyrick, Entom. Mitteil., Suppl. No. III, p. 46 (Jan. 1914)(3).

This species has been recorded from Maskeliya (Ceylon)(1), the Khasis(1) and Formosa(3). I found it not uncommonly in the larval stage at Maskeliya in March 1909 but have never seen any specimens in the Khasi Hills.

The larva feeds inside the seed-capsules of *Begonia* sp., both cultivated and wild varieties. A full-grown larva found at Maskeliya on 7th March 1909 was described as 6 mm. long, stoutly built, thickest about mesothorax and gradually tapering posteriorly; head pale yellow without any markings except the black ocelli and ferruginous jaws; other segments creamy-yellow with a narrow pale ferruginous median line ill-defined anteriorly; a broader pale ferruginous lateral line passes just above the spiracles, which are high-placed; each segment divided transversely by a vertical constriction of the skin-surface into two sub-segments of which the anterior is one-and-a-half to twice as large as the posterior; legs and prolegs transparent pale yellow,



Platyptilia taprobanes.—
a. Larva;
b. Pupa;
Moth, natural sizes and magnified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EXPLANATION OF PLATE IV.

PLATYPTILIA PUSILLIDACTYLA.

Fig. 1. Twig of *Lantana camara*, showing leaves, flowers (orange-yellow variety) and fruits (natural size).

" 2. Egg, as laid on flower, magnified (×7).

" 3. Egg, more highly magnified (×43).

" 4. Flower attacked by larva. Note sickly appearance in comparison with healthy flower on left.

" 5. Flower attacked by larva, opened up, showing larva at base of flowers, magnified.

" 6. Larva, magnified (×7).

" 7. Fruit-cluster formed from flower-head in which a larva has fed and pupated. Note scanty formation of fruits in comparison with healthy cluster on left.

" 8. Enlarged view of attacked flower-head in which a larva has pupated. The head of the pupa is seen projecting from the interior of cocoon which has been partially opened.

" 9. Pupa, magnified (×7).

" 10. Moth, in resting position, natural size.

" 11. Moth, with wings expanded, magnified.

hooks of latter black; the whole surface of the body thickly covered with minute black spiracles and more sparsely with short white secondary hairs; primary hairs rather short white, warts inconspicuous.

Another larva was of a pale greenish-yellow, the ferruginous markings barely represented by a slight darkening of the ground-colour.

The pupa is attached to the outside of a seed-capsule of the foodplant. It is about 7 mm. long, moderately stout, dull pale yellow, with an indistinct dorsal ferruginous stripe and a broad ferruginous lateral stripe reaching to the spiracles; the sixth segment with a large flattened latero-dorsal tricuspidate halberd-shaped projection; seventh to eleventh segments with smaller projections directed anteriorly: cremaster double.

A larva which suspended itself on 8th March pupated that night and emerged on 17th March.

PLATYPTILIA TAPROBANES, FELD. (PLATE III, FIG. 1.)

Platyptilia taprobanes, Felder, Reise "Novara", t. 140 f. 54(1); Moore, Lep. Ceylon, III, 527(2); Meyrick, T. E. S., 1907, 482 (1908)(3); Fletcher, Spol. Zeylan., VI, 14 (1909)(4).

Platyptilia sythoffi, Snell., Tijd. v. Ent., XLVI, 54, t. 5 ff. 15, 16(5).

This species is known from Ceylon (Hills)(4), Palnis(3), Khasis(3) and West Java(5). We have specimens from Madulsima, the Shevaroys, Coimbatore, Pusa and Shillong.

At Shillong the larva feeds commonly on *Scutellaria discolor*. The figure is taken from a spirit specimen.

PLATYPTILIA PUSILLIDACTYLA, WLK. (PLATE IV.)

Oxyptilus pusillidactylus, Wlk., Cat. XXX, 933 (1864)(1).

Platyptilia pusillidactyla, Wlsm., P. Z. S., 1891, 495(2), *id., l.c.*, 1897, 57(3); Meyr., T. E. S., 1907, 483 (1908)(4); Fletcher, Spol. Zeylan., VI, 13, t. A f. 2, t. E ff. 5, 6 (1909)(5), T. L. S. (2) XIII, 313 (1909)(6), *l.c.*, 399-400 (1910)(7), S. Ind. Ins., p. 444, f. 321 (1914)(7A), Entl. Note 73 (1916)(8), Proc. Second Entl. Meeting, p. 39 (1917)(9).

Platyptilia tecnidion, Zell., Hor. S. E. Ross, XIII, 468-469, (t. 6 f. 162 (1877)(10).

Platyptilia hemimetra, Meyr., T. E. S., 1886, 18(11), B. J., XVII, 135 (1906)(12).

Platyptilia lantana, Busck, Insec. Inscit. Menstr. II, 103-104 (1914)(13).

Originally described from Jamaica(1) this species is very widely distributed and has been recorded from the West Indies(2, 3), Mexico(5), Reunion(12), India(7-9), Ceylon(5), Hongkong(7) and Hawaii(7, 13). It was introduced into Hawaii from Mexico to aid in reduction of *Lantana* infestation, but its

distribution in other regions appears to be natural. It is abundant in India, Ceylon and Burma in every district which has been invaded by *Lantana*, and we have specimens from Trincomali, Kandy, Haldummulla, Madulsima, Peradeniya, Ootacamund, Sidapur, Pollibetta, Coimbatore, Bababudin Hills, Pusa, Shillong and Maymyo, and also from Honolulu.

"The egg is about 0·4 mm. long by about 0·22 mm. broad, and is of a very pale greenish-yellow colour (almost colourless); one end seems larger than the other and this larger end is studded with little prominences, especially noticeable in the micropylar area "(5).

The egg is 0·33 mm. long and 0·17 broad, pale yellow, opalescent, in outline ellipsoid, somewhat flattened, translucent, the surface covered with an irregular network of ridges. It is laid among the spines on the sepals of the florets of *Lantana camara*, sometimes on the leaves or on the petals. (Y. Ramachandra Rao's *Lantana* Cage-slip 1.)

Eggs laid at Coimbatore on 8th-9th December hatched on 12th-13th December.

The newly hatched larva is less than 1 mm. long, pale, translucent, head shiny black, prothoracic shield pale brown.

"The larva is stout, pale yellow and naked—at least, no hairs are visible to the unaided eye. The larva is usually found coiled round at the base of the flower-tubes in the interior of a *Lantana* flower "(5).

The larva is about 6 mm. long and about 1 mm. broad, cylindrical, uniform chrome-yellow; head light brown; five pairs of small thin prolegs.

The larva is found boring the thickened rachis [of *Lantana camara*] in which its tunnel may be found; it also bores into the sessile fruits from inside the tunnel only to eat the substance of the seed. It never comes out of its tunnel. Before pupating it forms a sort of cocoon by lining the tunnel with white silk and covering the mouth of the tunnel by a silken arch on which black pellets of excrement may remain attached. (Pusa Insectary Cage-slip 815).

Besides *Lantana camara*, the larva feeds in the flowers of *Lantana indica* and *Lippia geminata*.

"The pale yellow pupa is to be found in a sort of chamber gnawed into the side of the fruit receptacle, a regular cocoon being formed of bits of vegetable matter spun together with silk. The emerged pupæ are usually found projecting half-way out of the cocoon amongst the ripening fruit, such bunches of fruit being far less productive than unattacked ones "(5).

The pupa is about 5 mm. long, cylindrical, tapering to a point posteriorly, uniform chrome-yellow; legs-cases free ventrally and produced nearly to

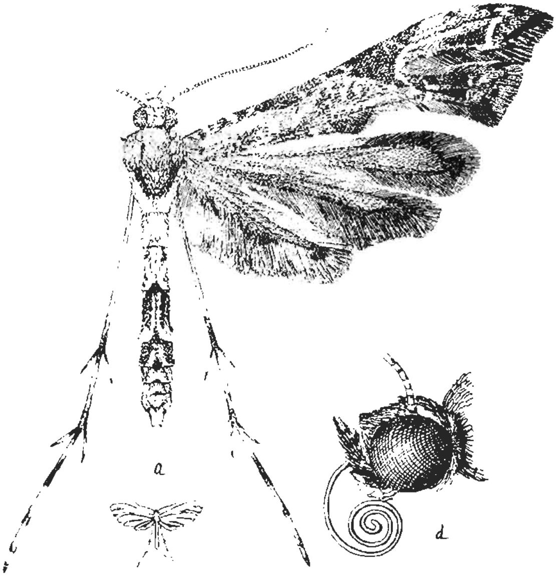
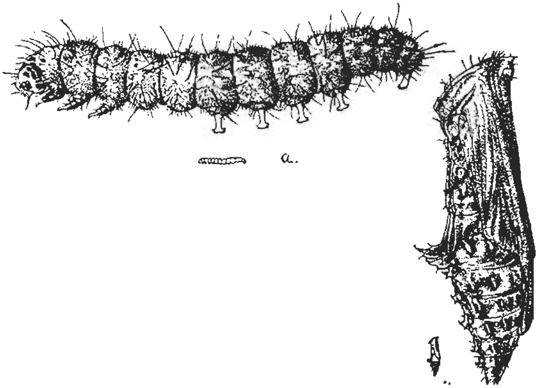


Fig. 1. *Platyptilia direptalis*:—
a. Moth, natural view size and magnified (x 9);
d, Side view of head, more highly magnified.



anal extremity; each abdominal segment dorsally with two raised elongated ridges; anal segment with several thin curved-tipped hairs. (Pusa Insectary Cage-slip 815.)

The pupal period is about four days in the hot weather and about a week in the winter.

PLATYPTILIA BRACHYMORPHA, MEYR. (PLATE III, FIG. 2.)

Platyptilia brachymorpha, Meyr., T. E. S., 1888, 240 (1888)(1), B. J., XVII, 135 (1906),(2) T. E. S., 1907, 483 (1908)(3); Fletcher, Spol. Zeylan, VI, 12, t. A f. 3 (1909)(4), T. L. S. (2) XIII, 401 (1910)(5).

Platyptilia seeboldi, Hofm., Iris, XI, 33 (1898)(6).

This is a widely distributed species recorded from Syria, India, Ceylon, South Africa, Aldabra, and Hawaii(5). In India and Ceylon it seems to occur in the Plains. We have it from Kegalle, Sidapur, Pollibetta, Pusa, Chakradharpur and Pyinmana (Burma).

It has been reared at Pusa from larvæ collected on *Celsia coromandeliana* on 7th February 1906 and 1st March 1913 and from a pupa found on an unidentified yellow-flowered Solanaceous plant on 5th April 1918.

The larva bores into flower-buds of *Celsia coromandeliana* and eats the anthers. It is, when full-grown, about 8 mm. long and rather more than 1 mm. broad, cylindrical, tapering slightly towards either extremity, segments distinct, brownish-grey with a pinkish-grey dorsal line deeper in colour posteriorly; head bilobed, shiny, translucent pale yellowish-brown with black specks and minute hairs; thorax with minute black spots and dull-white tufts of hairs; legs well developed; abdominal segments rather darker tinged; prolegs pale yellow; anal segment with a large black spot; tufts of small hairs on segments. (Pusa Insectary Cage-slip 978.) Another larva was described as yellowish-green, dorsal line deeper green. (Pusa Insectary Cage-slip 300A.)

Pupation takes place on the foodplant. The pupa is about 8 mm. long and slightly more than 1 mm. broad, yellowish-green with a pale crimson dorsal line posteriorly from thorax, abdominal segments with pale crimson lines. The pupal period is seven or eight days. (Pusa Insectary Cage-slip 978.)

PLATYPTILIA DIREPTALIS, WLK. (PLATE V.)

Oxyptilus direptalis, Wlk., Cat. XXX, 934 (1864)(1).

Platyptilia direptalis, Meyr., T. E. S., 1907, 485 (1908)(2); Fletcher, Spol. Zeylan., VI, 12 (1909)(3).

Originally described from the Cape of Good Hope(1), this species has since been recorded from Ceylon (Pattipola), the Palnis, Nilgiris and Simla(2). We have it from Dungagali (8,000 feet; Hazara District), Pusa and Shillong.

At Shillong the larva is found commonly on *Teucrium quadrifarium* and *Scutellaria discolor*. Figures 1*a* and 1*b* are made from spirit specimens of the larva and pupa.

PLATYPTILIA MOLOPIAS, MEYR.

Platyptilia molopias, Meyr., B. J., XVII, 135 (1906)(1); Fletcher, Spol. Zeylan., VI, 12-13, t. A f. 1, t. E f. 4 (1909)(2).

This species is common in the Hill Districts of Ceylon but does not appear to have been found in India hitherto. We have it from Maskeliya, Haldummulla and Pattipola.

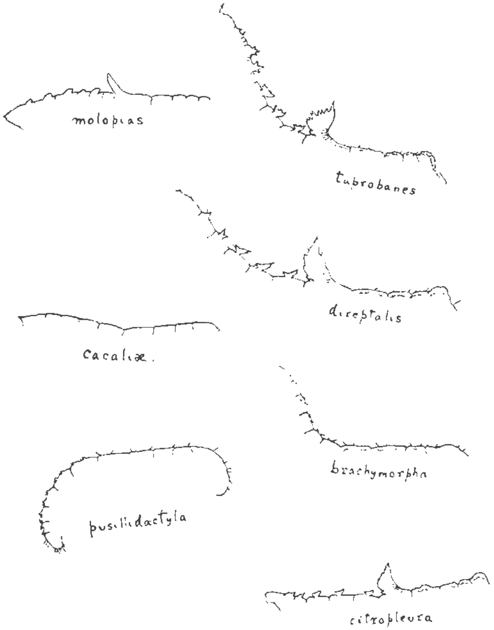
"The egg is about 0·47 mm. long by about 0·3 mm. broad, the micropylar end distinctly the larger and flattened; in colour it is of a very pale green, the surface reticulated with large but shallow rounded depressions.

"Larvæ were found on 18th May 1908 at Madulsima, feeding on the flowers and unripe seeds of *Teucrium tomentosum*. The larva is of a very pale green colour and is very difficult to discern when *in situ* on the foodplant. Half-grown examples often seem to have a narrow reddish medio-dorsal stripe, lacking in adults, which latter have sometimes some lateral reddish markings on the thoracic segments. Like all "plume" larvæ, however, this one is very variable in colour, and some examples might be described as reddish with a greenish latero-dorsal suffusion on the abdominal segments. The head is yellowish or pale green, the ocelli very distinctly marked in black. The segmental divisions are sharply distinct. All primary hairs are white; the longest hairs are a little longer than the diameter of the segments on which they arise. The legs are yellowish-green, extremities of claws yellowish. Prolegs very transparent pale green, hooks reddish. Spiracles very inconspicuous. Secondary hairs short, black.

"The pupa is suspended freely by the tail from an empty flower-sheath of the foodplant. It is rather short, the appendage sheaths very long and well separated. Colour a pale flesh-pink, mottled longitudinally with brown; head and wing-sheaths pale greenish, the latter with longitudinal brown shading. Dorsal prominences small, distinct, subequal, directed forward, except the first, which is extremely large, directed backwards, blunt, but tipped anteriorly with a sharp spine whose point is bent forward. This large prominence is sharply outlined by a deep brown shading which reaches obliquely anteriorly half-way across the wing-cover. A second brown shade, parallel to the first but less intense and narrower, occurs on the sixth segment, but barely reaches on to the wing-sheath.

"The moth emerges from the pupa after about a week"(2).

PLATE V



lines of dorsal segments of pupæ of various species of *Platyptilia* (x 7).

PLATYPTILIA CACALIÆ, n. sp.

Male and female. Expanse 16 mm. Palpi porrect, short, second joint dilated with scales, third with short rough scales, short, acuminate; greyish, fuscous externally. Head greyish-fuscous. Antennæ greyish, obscurely ringed with fuscous. Thorax greyish-fuscous. Legs whitish, dilated with brownish scale-tufts at apices of tarsi; posterior tibiæ greyish, irrorated with fuscous and obscurely broadly banded at origins of spurs which are whitish, brownish at base and apex. Abdomen moderately long, greyish, irrorated with fuscous which tends to form a patch in middle of back.

Forewing cleft from about $\frac{3}{4}$: first segment broadening posteriorly, apex falcate, posterior angle well marked; second segment broadening posteriorly, both angles well marked, termen sinuately convex: brownish-grey irrorated with white and reddish-brown: costal area strongly irrorated with blackish; an elongate blackish dot in cell beyond 1/3; a large blackish costal triangle at 2/3, its apex running obliquely into basal half of second segment, its outer edge irregular and not touching base of cleft; first segment with very ill-defined whitish bars at $\frac{1}{4}$ and $\frac{3}{4}$, first only evident towards costa, second followed by a clearly-defined terminal blackish suffusion narrowest at apex and broadening regularly to posterior margin of segment; second segment with clearly defined blackish suffusion on posterior fourth, preceded by an ill-defined whitish bar. Cilia on costa blackish with a few scattered whitish scales, beyond costal triangle narrowly whitish, and mixed with whitish before apex; on termen ochreous-white, black at base; within cleft ochreous-white with a few scattered black scales, black opposite terminal black suffusion; on dorsum ochreous-white with scattered black scales tending to form a broad weak scale-tooth at about 3/5.

Hindwing cleft from about 2/5 and 1/6: first segment dilated posteriorly; second segment dilated posteriorly, subtriangular, apex very acute, termen concave, hinder angle distinct; third segment sublinear, tornus almost obsolete: fuscous-grey, irrorated with fuscous-brown. Cilia brownish-grey; around apex and tip of second segment blackish; on dorsum paler, with a rather weak black scale-tooth at about $\frac{1}{2}$, preceded by a few scattered black scales and followed by a smaller number of weaker black scales.

Coimbatore; 5th December 1917 (*Fletcher*). Adults flying over flowers of *Cacalia coccinea*, in the flower-heads of which the larvæ and pupæ were found. Twelve specimens.

This species is superficially very like *P. molopias*, but is evidently distinct from the form of the pupa. At the time of capture it was supposed to be *P. molopias* and no description of the larva was made.

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PLATYPTILIA GONODACTYLA, SCHIFF.

Alucita gonodactyla, Schiff. and Den., Schmett. Wien., p. 320 (1775)(1).
Platyptilia gonodactyla, Tutt, Brit. Lep., V, 201-219 (1906)(2) ; Meyr., Rec. Ind. Mus., V, 217(3).

This is a widely-distributed European species which extends into the Northern portion of the Indian Region. It has been recorded from Darjiling(3) and Rawalpindi(3).

In Europe the larva feeds on *Tussilago farfara*. The early stages are described at length by Tutt(2), but have not been found in India as yet.

STENOPTILIA ZOPHODACTYLA, DUP.

Pterophorus zophodactylus, Duponchel, Hist. Nat., XI, 668, t. 314 f. 4 (1838)(1).
Adkinia zophodactylus, Tutt, Brit. Lep., V, 319-334 (1906)(2).
Stenoptilia zophodactyla, Meyr., Ent. Mo. Mag., 1907, 146 (1907)(3), T. E. S., 1907, 504 (1908)(4) ; Fletcher, Spol. Zeylan., VI, 10-11, t. E f. 3 (1909(5).

This is a widely distributed species, known from Central and Southern Europe, Asia Minor, Armenia, India, Ceylon, Eastern Australia and Argentina. We have specimens from Lunugala (Ceylon), Ootacamund, Bababudin Hills (Mysore), Pusa, Peshawar, Abbottabad, Kashmir, Parachinar, Hangu (Kurram Valley) and Cherrapunji.

Very detailed descriptions of the egg, larva and pupa, taken from English specimens, are given by Tutt, pages 322-331(2). The following descriptions of the larva and pupa were made from Sinhalese specimens :—" The larva, at rest and apparently about full-fed, is about 10 mm. long, stout, stoutest about third segment and tapering thence gradually. Head pale yellow with black ocelli. Colour a pale green, the spiracles narrowly ringed with black ; they are situated about half-way up the segments but do not seem raised above the skin-surface at all. There is a broad medio-dorsal stripe, purple at the edges, but very dark internally. This is narrowly and obscurely edged by a narrow whitish-green longitudinal stripe, of a tint slightly paler than the ground-colour. Half-way between the lower edge of this stripe and the spiracle is a second similar whitish-green stripe, and a third similar stripe occurs on the latero-ventral surface at a distance below the spiracle equal to that of the second stripe above it. The two latero-dorsal setigerous tubercles are situated at a horizontal distance apart equal to about one-third of the width of the segment ; the foremost one bears a short black hair, the aftermost a similar white hair ; the tubercles themselves are very small and inconspicuous. Just above the spiracle occurs a short white hair, directed outwards.

Just below the spiracle are (1) a very short white hair directed forward, (2) a short white hair directed backward. The whole body, particularly on the dorsal and ventral regions, is thickly covered with minute short black bristly hairs. The legs are fairly large and are yellowish in colour ; prolegs rather small, greenish yellow. The larva feeds on the flowers and seeds of *Sopubia trifida.*

"In the case of another larva, the sixth and eleventh segments had a round pale spot in the purple dorsal stripe on each side of its central darker line.

"The pupa is long and narrow, of a pale yellowish-green colour with a broad purplish-red dorsal stripe ; the usual white hairs are so short that they are only just perceptible under a lens. The larval skin is discarded entirely and is shrunk up into a minute pellet. The pupa is capable of rapid and violent motions in the ventro-dorsal plane, the head being bent backwards dorsally until it touches the anal extremity. The pupa is suspended head downwards, ventral surface against support "(5).

At Pusa this species has been reared from larvæ found on *Kukraunda* (*Blumea balsamifera*) on 18th February 1908. The larvæ were feeding on the green leaves from which they dropped by a thread when disturbed ; the larva does not eat the edge of the leaf but nibbles small holes in the upper, and occasionally in the lower, surface of the leaf. Its movements are sluggish.

The larva was described as about 8 mm. long and 1·5 mm. broad, cylindrical, tapering posteriorly, yellowish-green ; head green, tinged with yellowish or brownish anteriorly, covered with microscopic white hairs ; prothorax with two transverse rows of white spinous hairs and with smaller dark secondary hairs ; legs greenish-yellow ; abdominal segments distinctly segmented, with an irregular interrupted dull yellowish lateral stripe and a deep green dorsal stripe, tubercles armed with bunches of white spines and black hairs ; spiracles small, round, black.

Pupation takes place on the surface of a leaf, the pupa being very similar in colour to the larva. Before pupation the larva applies a long narrow network of silken threads to the surface of a leaf and the pupa attaches itself to this by the double set of cremastral hooks. The pupa is about 8 mm. long and 1·5 mm. broad across thorax, head depressed, thoracic region prominent, tapering almost to a point anally ; a few white spiny hairs scattered over surface ; a brownish dorsal stripe ; wing-cases nearly reaching anal extremity. One individual, which pupated on 26th February, emerged on 7th March 1908. (Pusa Insectary Cage-slip 652.)

EXELASTIS LIOPHANES, MEYR.

Marasmarcha liophanes, Meyr., T. E. S., 1886, 19([1]).

Exelastis liophanes, Meyr., B. J., XVII, 136([2]); Fletcher, Spol. Zeylan., VI 33-34, t. A f. 12 (1909)([3]), T. L. S. (2) XIII, 403 (1910)([4]).

Leioptilus griseodactylus, Hofm., Zoologica, XXIX, 240 (1900)([5]).

Originally described from Reunion([1]), this species has been recorded from Barbados, Natal, Seychelles, Ceylon, Formosa, China (Fuchau) and the Bismarck Archipelago. It is abundant throughout the Plains of India, Burma and Ceylon, and we have specimens from Haldummulla, Peradeniya, Coimbatore, Virajpet (S. Coorg), Cuttack, Hoshangabad, Pusa, Palamau, Lumding (Assam), Shillong, Lashio, Tatkon and Myitkyina.

This species was bred at Pusa in July 1910 from pupæ found on the upper surfaces of leaflets of *Oxalis* sp. The larva has not been noted, but almost certainly feeds on *Oxalis*, probably on the flowers.

EXELASTIS PHLYCTÆNIAS, MEYR.

Marasmarcha phlyctænias, Meyr., B. J., XXI, 106 (1911).

Described from Trincomali and Puttalam and from North Coorg. We have specimens from Colombo, Kegalle and Haldummulla. The early stages are unknown.

EXELASTIS ATOMOSA, WLSM. (PLATE VII.)

Aciptilia atomosa, Wlsm., P. Z. S., 1885, 885([1]).

Exelastis atomosa, Meyr., B. J., XVII, 730([2]); Lefroy, Ent. Mem., I, 210 ff. 67, 68([3]), Ind. Ins. Life, pp. 527-528, t. 53([4]); Fletcher, S. Ind. Ins. pp. 444-445, t. 38 (1914)([5]), Proc. Second Entl. Meeting, pp. 44, 56 (1917)([6])

Exelastis parasita (Meyr., *ined.*), Lefroy, Ind. Ins. Pests, p. 140, figs.

Pterophorus ebdalensis, Rebel, Lep. Sokotra, p. 84 (1907)

nec

Exelastis atomosa, (*nec* Wlsm.), Fletcher, Spol. Zeylan., VI, 33, t. A f. 11 (1909) [=*phlyctænias*, Meyr.].

Originally described from Bombay ([1]), this species is widely distributed in the Plains of India, but does not appear to occur in Ceylon, where it is replaced by *E. phlyctænias*, Meyr. It is an important pest of *Cajanus indicus* and *Dolichos lablab*. We have it from Peshawar, Abbottabad, Pusa, Samastipur, Bilaspur (C. P.), Hoshangabad, Bhopal, Baroda, Poona, Yemmiganur (Bellary) and Coimbatore.

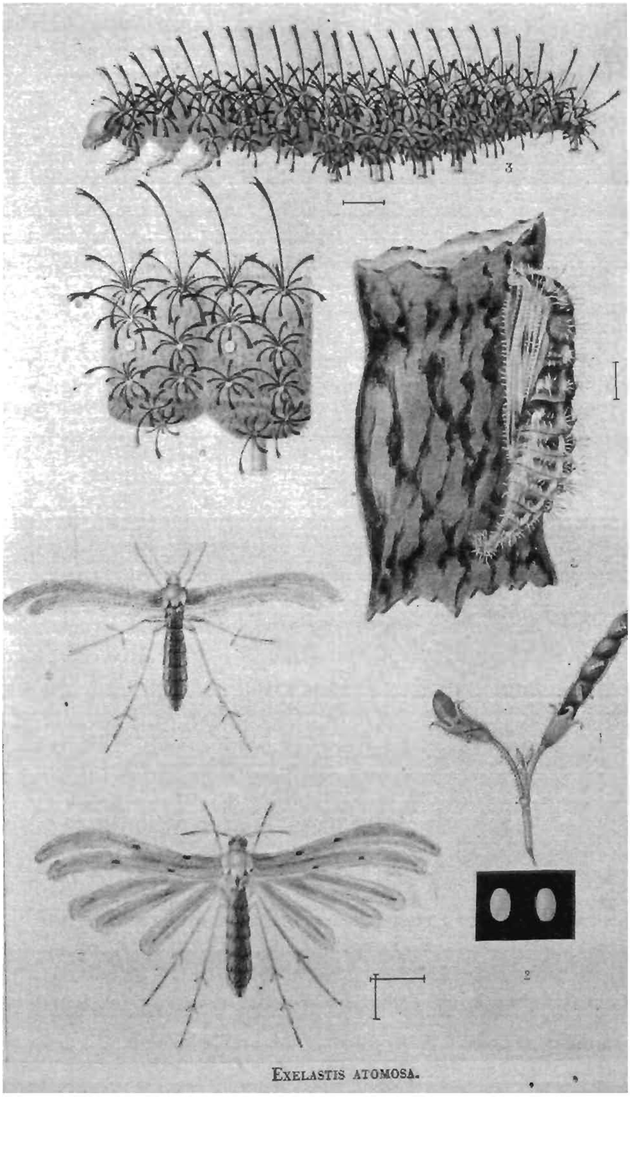
Outside of India, *E. atomosa* is known from Natal, Sokotra, and New Guinea. It will probably be found to be widely distributed throughout the tropical regions of the Old World.

EXPLANATION OF PLATE VII.

EXELASTIS ATOMOSA.

Fig. 1. Eggs on pod of pigeon-pea (*Cajanus indicus*).
„ 2. Eggs, magnified.
„ 3. Larva, magnified.
„ 4. Second and third abdominal segments of larva.
„ 5. Pupa on pod of pigeon-pea (*Cajanus indicus*), magnified.
„ 6. Moth, in normal resting position.
„ 7. Moth, with wings expanded.

(The hair-lines show the natural sizes.)



EXELASTIS ATOMOSA.

Life-history. The egg is oval in outline, round in section, measuring about half a millimetre in length. It is, when laid, light green or bluish, becoming yellower as it approaches hatching. Eggs are laid at night, each egg singly, several being found on each young pod, flower-bud or young leaf. They are difficult to find and escape notice unless one knows what they are like and is looking specially for them. Eggs hatch in three and a half to four days in warm weather, in five to six days in the winter in the Plains. The larva simply bites a hole in the egg and crawls out, leaving the empty white egg-shell which it does not eat. (Plate VII, figs. 1, 2.)

Larva. The newly-hatched insect is about one millimetre long, yellow, the segments covered with short hairs. As it grows older the colour becomes green, or green with brown markings, closely resembling the colouring of the pod it is feeding on. The segments are clothed in hairs and capitate spines, the latter in distinct rosettes. There are five pairs of green prolegs. (Plate VII, fig. 3.) The larva, on hatching, eats into the pod and feeds upon the seeds; or it bites into the unopened flower-bud and attacks the developing anthers. It never actually goes completely into the pod but stretches in from outside. This caterpillar is much like that of *Sphenarches caffer* and is found abundantly with it upon the buds and pods of pigeon-pea in the cold weather. The larval life lasts for 16 to 21 days in warm weather, from 25 to 30 days in the cold weather.

Pupa. Pupation takes place on the plant, openly. The manner of pupation is the same as that of *Sphenarches caffer*, and the pupa is similarly attached at two points to the silken pod by means of circinate spines forming two cremastral pads, one at the anal extremity and the other on the lower surface of the eighth abdominal segment. It is green, grey, or brown, and is, like the larva, cryptically coloured. The pupal period is from three to five days in the hot weather, seven days in the cold weather. (Plate VII, fig. 5.) Emergence from the pupa is effected by the rupture of the pupal integument along the median line from the vertex to the end of the midventral line of the thorax.

The moth is shown in Plate VII, fig. 6; the wings are normally held so that only the narrow forewing is visible. It is found flying in the dusk, resting by day on the lower surface of a leaf or on any convenient surface. Mating may take place soon after emergence, and oviposition the next night; even in captivity without food the moths survive for ten days. In the insectary one moth laid a total of 94 fertile eggs, laying over thirty the first night, the remainder on four subsequent nights.

The following tables give normal life-histories in March-April ; the periods are longer in December-January as stated above :—

Eggs laid	Eggs hatched	Larvæ pupated	Moths emerged	Total
23-III	27-III	14 to 17-IV	19 to 22-IV	27—30
24-III	28-III	16-IV	21-IV	28
25-III	29-III	14-IV	17 to 19-IV	23—25

Occurrence. In the life-history as detailed above, there is no stage in which long periods of rest would appear to be undergone and hibernation or any such resting stage would seem to be impossible. Yet such resting periods must occur in actual fact ; the normal foodplant of this insect is the pigeon-pea (*Cajanus indicus,* known as *arhar, tur* or red gram) which is sown with the monsoon, say in July, and which flowers and bears pods in December-January in some parts of India, in March-April in others. There is thus abundant food for some months only, while this crop is coming into flower and pod, and it is then that it is found in abundance in all stages. The pest has been under fairly close observation in several places and there is a long gap between the crops of pigeon-pea which is apparently bridged in one of several ways. The leguminous plant *kulthi* or lablab bean (*Dolichos lablab*) is an alternative foodplant found in the rains before the pigeon-pea is producing flower-buds, and to a very small extent this insect has been found breeding on this plant. This has not been recorded in Pusa and the only known way in which the moth is known to live over in Pusa from April to December is as an imago in shelter in thick grass. A considerable amount of attention has been paid to the fauna of thick grass and this species has been found occasionally during the months when it is known to breed. It has been found only in this way during this time and only in small numbers in the moth stage.

We believe that normally it lives over from April to December as a moth in hiding, emerging when the pigeon-pea is coming into bud to breed ; in localities where there is a constant supply of its alternative foodplant, it emerges earlier and breeds in small numbers on this. That is, in some localities where *kulthi* is regularly grown, a summer brood is found on it ; in other places it is not. We may contrast this with *Sphenarches caffer* which has these two foodplants, but also breeds on Cucurbitaceæ, which are freely cultivated from April to December, so that the latter can find foodplants throughout the year. It is possible that *Exelastis atomosa* has wild alternative foodplants, but there is as yet no evidence to support this and, had they occurred in Pusa, we believe they would have been found.

PTEROPHORUS LIENIGIANUS, ZELL.

Pterophorus lienigianus, Zeller, Linn. Ent., VI, 380 (1852)(1); South Entom., XV, 105, t. 2 f. 3(2); Meyr., Handb., p. 439(3), T. E. S., 1907, 497(1908) (4); Fletcher, Spol. Zeylan., VI, 34-35 (1909)(5), S. Ind. Ins., p. 445, f. 322 (1914)(6), Proc. Second Entl. Meeting, p. 288 (1917)(7).

Leioptilus serindibanus, Moore, Lep. Ceylon, III, 527, t. 209 f. 14(8).

This species, originally described from Central Europe(1), occurs throughout India, Burma and Ceylon. We have specimens from Anuradhapura, Coimbatore, Godavari District, Peshawar, Pusa, Shillong, and Maymyo.

In Europe the larva has been recorded as feeding on the terminal leaves of *Artemisia vulgaris* and has been described as "pale bluish-green; dorsal line broad, darker; sub-dorsal yellow-whitish; head brown, blackish-marked" (3).

In India the larva feeds on brinjal (*Solanum melongena*) and has been described as "about 8 to 10 mm. long, moderately stout, hairy, very pale yellowish, head brown"(6). It has also been reared at Pusa from larvæ found on 26th March 1917 rolling and feeding on leaves of an unidentified weed locally called *khagra* (Pusa Insectary Cage-slip 1538).

PTEROPHORUS MONODACTYLUS, LINN

Alucita monodactyla, Linn., Syst. Nat. (ed. X) I, 542 (1758)(1).

Pterophorus pterodactylus, Buckler, Larvæ Brit. Butt. Moths, p. 365 (1901)(2).

This species is very widely distributed throughout Europe and North America, and occurs in the North-West Frontier Province and in Kashmir. We have specimens from Parachinar (Kurram Valley).

The larva feeds on various species of *Convolvulus*, *Chenopodium* and *Atriplex* and has been described by Porritt(2) as about 15 mm. in length and stout in proportion, head polished and rather small, body uniform and cylindrical, tapering a little posteriorly, segmental divisions well defined and deeply cut ventrally, each tubercle emitting a tuft of short but rather strong hairs; ground-colour bright yellowish-green, more decidedly green dorsally; head pale yellow, mandibles light brown; dorsal stripe narrow but distinct, yellowish white; a much broader yellowish-white spiracular stripe, the space between this and spiracles freckled with streaks and spots of the same colour; spiracles black, hairs greyish; ventral surface, legs and prolegs uniformly pale green.

PSELNOPHORUS ALBITARSELLUS, WLSM.

Alucita albitarsella, Wlsm., in Swinh., Cat. Lep. Het. Oxford Mus., II, 542 (1900).

This species was described from a single specimen from Ootacamund. I have examined this (type) specimen in the Oxford Museum and make it to be a *Pselnophorus* and not an *Alucita*. We have a specimen from the Palni Hills.

"Larva white, about half an inch long, with a few long hairs scattered about its body. It burrows into the shoots of a common jungle plant. Pupa suspended by tail from underside of a leaf (*Minchin*)".

ALUCITA NIVEODACTYLA, PAG.

Alucita niveodactyla, Pag., Zoologica, XXIX, 240 (1900) (1); Meyr., T. E. S., 1907. 490 (1908)(2); Fletcher, Spol. Zeylan, VI, 36, t. F f. 9 (1909)(3); Poulton, Proc. Ent. Soc. Lond., 1909, p. 39(4).

Aciptilia nivea, Snell., Tijds. voor Ent., XLVI, 56, t. 5 f. 17(5).

This species is widely distributed and is recorded from the Bismarck Archipelago(1), Java(5), Cochin China(4). the Philippines(2) and Ceylon(3). In India and Ceylon it is apparently confined to the Hill districts. We have it from Shillong and Cherrapunji.

"The larva feeds on the young leaves of an *Ipomœa*, eating the leaves from the outside and not entering within the unexpanded leaf in the manner of *Steganodactyla concursa*. In colour it is of a uniform pale yellowish-green thickly studded with long fasciculated tufts of whitish hairs, of which those of the dorsal row are the longest and sometimes tipped with brown. These hair-tufts are extremely complicated, and their appearance will be best understood from the rough sketch of a larval segment (Plate F, fig. 9); under the microscope these tufts of long hairs recall the armature of spines exhibited by an Echinid "(3).

"The pupa is green, thickly covered with pale green spinous hairs and with an interrupted dorsal and sub-dorsal row of black spots. The moth emerges after about a week "(3).

STEGANODACTYLA CONCURSA, WLSM.

Steganodactyla concursa, Wlsm., Ent. Mo. Mag. 1891, 241(1), Novit. Lepidopt. t. 12 f. 3(2); Fletcher, Spol. Zeyl., VI, 9, t. E ff. 1-2 (1909)(3).

This species is widely distributed in Ceylon and has been found in India at Belgaum and in Coorg. It has also been recorded from Sumatra by Hering (*Stett. Ent. Zeit.*, 1903, 96).

"The larva feeds between the young unexpanded leaves of a common climbing *Argyreia* and also of *Ipomœa populifolia*, eating the upper cuticular surface of the leaf into tell-tale patches.

"The full-grown larva may be described as stout, rather flattened; head pale yellow; other segments a pale greyish-green, interstices of segments (only visible when expanded) darker green; dorsal surface pale; warts with a little orange-yellow about their bases, often forming a distinct orange-yellow or reddish median stripe; an ill-defined broad dark lateral shade appears to be caused by the contents of the alimentary canal, as it disappears towards the anal extremity when frass is voided; hairs white, usually very conspicuous.

"In confinement the larva generally wanders off the foodplant to pupate but occasionally attaches itself to the upper surface of the midrib of a leaf. I have never found the pupa in nature.

"The pupa is usually suspended horizontally to a vertical support, being closely adpressed ventrally to the resting-surface by the double set of cremastral hooks. Its colour, which is variable, is some shade of pale green, but it always has a broad reddish medio-dorsal stripe. These colours fade into a greenish-brown shortly before emergence, which takes place after about six days, the moth generally appearing in the late evening, quite contrary to the usual habits of plume-moths. The pupa is comparatively extremely small, and it seems marvellous how such a large moth can emerge from a pupa-case which does not seem sufficiently large to contain its abdomen alone "(3).

Mr. Senior-White has also reared this species at Matale from *Lantana*, which is an unexpected foodplant.

AGDISTIS TAMARICIS, ZELL.

Adactyla tamaricis, Zeller, Isis, 1847, 899(1).

Agdistis tamaricis, Zeller, Linn. Ent., VI, 325(2); Milliere, Icon., III, 237, t. 126 ff. 5-7(3); Hofmann, Deut. Pteroph., p. 56(4); Wlsm., Entom. Rec., XIX, 54-55 (1907)(5).

Herbertia tamaricis, Tutt, Brit. Lep., V, 127-132 (1907)(6).

This is a widely-distributed species known from Europe(1), Cape de Verdes Islands(5), West Africa(5), Algeria(5), Cape Colony(5), Egypt, Arabia(5), and Karachi(5). We have a specimen, apparently of this species, from Peshawar.

The larva is described by Chapman(6). It feeds on *Tamarix*, but has not been found in India as yet.

This species may be looked for in all sandy areas where *Tamarix* grows commonly.

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA

II. CARPOSINIDÆ, PHALONIADÆ, TORTRICIDÆ AND EUCOSMIDÆ

BY

T. BAINBRIGGE FLETCHER, R.N., F.L.S., F.E.S., F.Z.S

Imperial Entomologist

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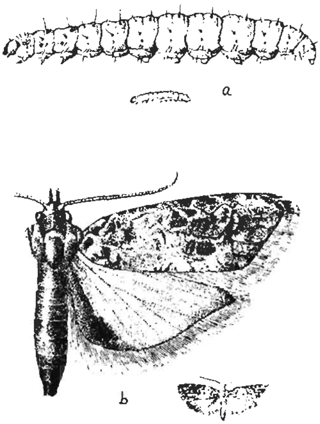

Fig. 1. *Carposina reprobata*:—*a.* Larva; *b.* moth, natural size and magnified.

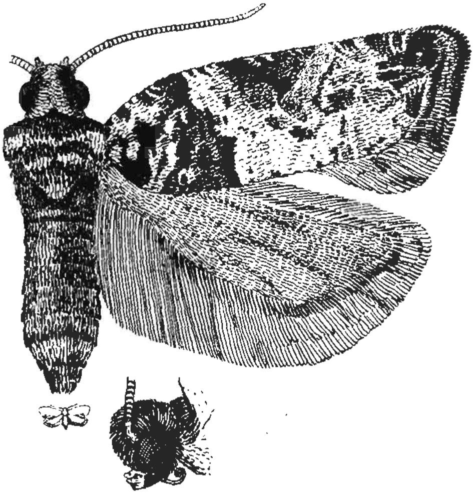

Fig. 2. ***Acroclita vigescens***:—Moth; natural size and magnified. **Below is seen a** more enlarged view of the **head** from the **side.**

LIFE-HISTORIES OF INDIAN INSECTS. MICROLEPIDOPTERA.

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CARPOSINIDÆ.

MERIDARCHIS SCYRODES, MEYR.

Meridarchis scyrodes, Meyrick, Exot. Micr., II, 30 (Oct., 1916) (1); Fletcher, Entl. Note No. 74 (1916)(2); Proc. Second Entl. Meeting, p. 254 (1917)(3).

Reared at Coimbatore "in February from larvæ living in fruits of *Zizyphus jujuba* (Rhamnaceæ)" (1) and has also been bred from *Zizyphus jujuba* fruit at Pusa in March and April(2). Also reared at Nagpur and Surat from *Zizyphus* fruits.

MERIDARCHIS REPROBATA, MEYR. MS. (PLATE VIII, FIG. 1.)

This species has been reared at Nagpur and Surat from larvæ in fruits of *Eugenia jambolana*. We have also reared it from olive fruits sent to us from Kashmir by Messrs. Mitchell & Co., in October 1917. The larva is about 10 mm. long and about 1·5 mm. across fifth abdominal segment, thence tapering towards either extremity (when the larva is at rest the hinder part of the abdomen appears very stout—see figure), dorsally pink, ventrally pale yellow; head yellow-brown, glossy; prothoracic shield large, longitudinally divided in middle, slightly darker than head; skin of body soft, glossy; tubercles brown chitinized spots bearing single rather long thin hairs; five pairs of equally developed prolegs. Moths emerged from these larvæ (at Pusa) between 19th November and 3rd December. (Pusa Insectary Cage-slip 1724.)

PHALONIADÆ.

CLYSIA AMBIGUELLA, HB.

Tinea ambiguella, Hubner, Tin., 153 (1801)(1).

Clysia ambiguella, Meyr., Handbk., pp. 556-557 (1895)(2); Wlsm., A. M. N. H. (7) V, 488 (1900)(3); Kennel, Pal. Tortric, iii, 240, t. 11 f. 45 (1913)(4).

Larva "pale brownish-yellow; head and plate of 2 black "(2). A well-known and very injurious pest of the vine in Europe, the larva feeding in the flower-buds. Not yet noted as a pest in India, though it is known to occur in Assam (Cherrapunji; Naga Hills), N. Manipur, and Pegu (Karen Hills).

PHALONIA HYBRIDELLA, HB.

Tinea hybridella, Hubner, Tin., 351(1).

Phalonia hybridella, Meyr., Handbk., p. 553 (1895)(2); Wlsm., A. M. N. H. (7) V, 486 (1900)(3); Kennel, Spuler's Schmett. Eur., II, 258, t. 84 f. 30(4).

Larva "pale pink; head light brown; plate of 2 yellowish, with four black dots; in seed heads of *Picris hieracioides* "(2).

A palæarctic species, recorded from Dharmsala(3). It is doubtful whether it is really Indian.

PHALONIA MANNIANA, F.R.

Cochylis manniana, Fischer v. Rosl., Abbild., p. 134, t. 51 f. 2(1).

Phalonia manniana, Meyr., Handbk., p. 549 (1895)(2), Rec. Ind. Mus., V, 217(3), P. Linn. Soc. N. S. W., XXXVI, 297 (1911) (4); Spuler, Schmett. Eur., II, 258, t. 84 f. 32.(5).

Larva in *Mentha* and *Lycopus*(5) in Europe.

This species has been recorded from India and Ceylon, extending to N. Australia(4), but in a later note Mr. Meyrick (Ent. Mo. Mag., 1916, 277-278) notes that the above record(4) is incorrect, the species in question being *P. mellita*, Meyr., whose early stages are as yet unknown.]

TORTRICIDÆ.

CAPUA INVALIDANA, WLK.

Tortrix invalidana, Wlk., Cat., XXVIII, 327 (1863)(1); Moore, Lep. Ceylon, III, 493 (1887)(2).

Epagoge invalidana, Meyr., B. J., XVIII, 617 (1908) (3).

Capua invalidana, Fletcher, Proc. Second Entl. Meeting, p. 300 (1917)(4).

Originally described from Ceylon(1), this species has since been recorded from Coorg and the Khasi Hills(3), and was reared at Nagpur in December 1915 from larvæ feeding on betel-vine leaves.

ADOXOPHYES PRIVATANA, WLK.

Dichelia privatana, Wlk., Cat., XXVIII, 320 (1863)(1).

Adoxophyes privatana, Wlsm., A. M. N. H. (7) V, 481-482 (1900) (2); Meyr., Gardiner's Fauna Geogr. Maldives, I, 126 (1902)(3), Proc. Linn. Soc. N. S. W., XXXV, 209 (1910)(4), Entom. Mitteil. Suppl., III, p. 47 (1914)(5).

Originally described from Moulmein, this species is very widely distributed in India, Burma and Ceylon and from Korea to New Guinea.

We have it from Coimbatore, Kallar (Nilgiris), Sidapur (Coorg) and Manantoddy (Wynaad).

This species has been bred at Coimbatore by Y. Ramachandra Rao from larvæ found in *Lantana* flowers. No description of the larva was recorded, but pupation took place in a folded leaf.

The pupa is 8 mm. long and 2 mm. broad, cylindrical, truncated anteriorly, anal segment conical, terminating in a flattened spatuloid chitinized process bearing four pairs of recurved hooks ; light translucent yellow, surface rather shiny. The wing-covers extend to the middle of the ventral surface of fourth abdominal segment. Dorsal surface of abdominal segments with three transverse ridges especially developed on fourth and succeeding segments, first ridge close to anterior margin and sharply excised, second ridge adjacent to first and carrying a row of sharp, short but rather stout spines, ranging from twelve to twenty in number, third ridge slightly behind middle of segment, sharp but with its edge broken into numerous close-set denticles.

A larva which pupated on 26th December 1916, emerged on 2nd February 1917, and a second larva which pupated on 26th-27th December 1916, emerged on 3rd-4th February 1917. Y. Ramachandra Rao (*Lantana* Cage-slip 21).

HOMONA COFFEARIA, NIETN.

Tortrix coffearia, Nietn., Obs. Enemies Coffee Tree in Ceylon, p. 24 (1861)(1).

Homona fasciculana, Wlk., XXVIII, 425(2).

Tortrix coffearia, Moore, Lep. Ceylon, III, 494 (1887)(3).

Homona coffearia, Fletcher, S. I. I., p. 452, f. 330 (1914) (4), Proc. Second Entl. Meeting, pp. 20, 28 (1917)(5).

"*Homona coffearia* is widely distributed throughout the tea districts of North-East India and has occasionally occurred in sufficient numbers to be noted by planters and specimens have on one or two occasions been received at the laboratory of the Indian Tea Association from managers of tea gardens, generally in Assam. Speaking generally, however, this insect is of comparatively little importance as a pest of tea in these parts.

"*There are two periods of the year at which the caterpillars are most conspicuous, viz., March to May and August to September. They attack* the topmost leaves of a [tea] shoot and the damage done in the early part of the season, though seldom serious, is greater than that done later in the season, for the following reason. The pest prefers succulent growth, and on this account will attack indigenous varieties of tea, on which the young leaves are soft and juicy, in preference to China or hybrid varieties, in which the young leaves tend to be more dry. *Similarly, the new growth on* cut-back tea is more succulent than that on tea which has been top-pruned, and hence bushes pruned in the former manner are more liable to attack than top-pruned bushes. Should a cut-back bush be backward in its growth in March it is *very liable to receive a very severe check if attacked by this pest, more* especially so, as the rule at this time of year is to pluck such tea to a measure, leaving all bushes untouched which have not yet grown up to that measure. Should a shoot be attacked after reaching that measure, the damage done is *negligible, as the pest and the attacked leaves are removed by the pluckers,* and the main object, which was to allow the new shoots to attain a certain growth, has been achieved. In August and September, however, such conditions do not obtain. The main object then (for August and September are the two months during which growth is most rapid as a rule) is to get the leaf off. The caterpillars are removed by the pluckers almost as soon as they become established and only a small proportion attain maturity.

"Thus ordinary garden operations as a rule exercise a sufficient check on the pest and, in cases where backward cut-back tea is affected in the early part of the season, it is now made a practice of plucking the affected tops off the shoots even if they have not attained the growth desired. The highest axillary bud then develops, and the shoot is afterwards left until it attains the desired measure.

"Specimens of the different pests of tea are continually being collected in the field and reared in this laboratory in the hope of finding parasites, but so far no parasites have been found to attack *Homona coffearia.*" (E. A. Andrews, *in litt.*, 17th January 1917.)

Homona coffearia was recorded (¹) as a tea-pest in the tea districts of Southern India on the authority of Mr. R. D. Anstead, and I have no first-hand knowledge of its occurrence on tea in Southern India at all. Probably it does occur, together with *Laspeyresia leucostoma* and perhaps other species. Specimens of *Homona coffearia*, taken at Pollibetta in South Coorg by myself, had probably bred upon coffee, as there was no tea near by. It has

also been reared in Southern India by Y. Ramachandra Rao from larva found feeding on *Lantana* at Kallar (Nilgiris) and Sidapur (Coorg).

HOMONA MENCIANA, WLK.

Pandemis menciana, Wlk., Cat., XXVIII, 310 (1863) (1).
Godana simulana, Wlk., Cat., XXXV, 1801 (1866) (2).
Tortrix pullatana, Snell., Tijds. voor Ent., XLIV, 68-69, t. 5 ff. 3,3*a* (1901) (3).
Capua menciana, Wlsm., A. M. N. H. (7) V, 482-483 (1900) (4).
Homona menciana, Meyr., T. E. S., 1910, 432 (5).

Originally described from Shanghai, *H. menciana* has since been recorded from Japan, China, India, Java, Borneo, Celebes, Timur, Batian, and the Moluccas. In India it has been found at Cherrapunji(4), in the Naga Hills(4) and in Sikkim(4), and we have it from Shillong and Darjiling and also from Southern India.

Homona menciana has been bred in Southern India by Y. Ramachandra Rao from larvæ folding tips of branches of *Lantana camara* at Kallar and webbing flowers and leaves on tip of a *Lantana* branch at Sidapur, Coorg.

The Kallar larva, when about to pupate, was described as 12 mm. long, cylindrical, rather stout, pale greenish to pale yellowish, posterior extremity rather dark green; head shiny black; prothoracic shield rather lighter than head with a conspicuous narrow pale anterior margin; shields on body rather large, circular, shiny, bearing rather long, slender hairs; legs and prolegs normal. It pupated on 3rd January and a female moth emerged on 10th January 1917.

The Sidapur larva was described as 19 mm. long, cylindrical, slightly flattened, brownish-green, with sparse greyish-green hairs; head small, flattened, reddish yellow, prothoracic shield greenish brown with a dark brown marginal line laterally and posteriorly but not anteriorly. It pupated on 18th May and the moth emerged on 25th May 1917.

Pupa (from Kallar larva) 12 mm. long and 3·5 mm. broad, reddish or yellowish brown, cylindrical, rather stout, blunted anteriorly, wing-sheaths barely reaching middle of dorsal surface of fourth abdominal segment, anal segment produced into a long blunt chitinized projection. Abdominal segments with three transverse dorsal ridges, first plain and sharply excised posteriorly, second composed of a row of strongly developed spines, third composed of a row of numerous smaller spines (which, however, are not so small or so numerous as in *Lobesia*). (Y. Ramachandra Rao's *Lantana* Cage-slip 33 and un-numbered slip dated 13th May 1917.)

CACŒCIA MICACEANA, WLK.

Cacœcia micaceana, Wlk., XXVIII, 314 (1863)(1); Moore, Lep. Ceylon, III, 492, t. 208 f. 1 (1887)(2).

Occurs throughout India, Burma and Ceylon. The larva has been found on guava and broad bean at Mandalay (K. D. Shroff coll.). We have also moths from Minbu (Lower Burma) and from Peshawar.

CACŒCIA EPICYRTA, MEYR.

Cacœcia epicyrta, Meyr., B. J., XVI, 589 (1905) (1), T. E. S., 1910, 432 (2).

Originally described from Ceylon, this species has since been found in India and Java. In India it is widely distributed and we have it from Madulsima, Maskeliya, the Shevaroys, the Palnis, Coimbatore, Pusa, Solan and Darjiling.

At Coimbatore it has been bred from a larva on *Duranta* fruits, and at Pusa from a larva boring a guava fruit.

Cacœcia epicyrta has been bred in Southern India on several occasions by Y. Ramachandra Rao from larvæ found on *Lantana camara*. The larva webs up adjacent flower-heads and feeds on the corollas, etc., as a rule, but is sometimes found also on shoots or on ripe fruits, which latter it webs up and feeds on their dried pulp and bores into the seeds but in most cases without injuring the embryos. It has been found on *Lantana camara* at Coimbatore, Kallar, Bangalore, Sidapur, Manantoddy and Yercaud.

A larva 8 mm. long is described as dark grey, slightly hairy, head shiny yellowish-brown, prothoracic shield shiny dark-brown. This larva was found on 21st November 1916, and moulted on 24th-25th November, after which it was 12 mm. long, dark grey, rather hairy, the hairs arising from whitish wart-like shields, head shiny yellow-brown, prothoracic shield very dark brown anteriorly edged with light brown. On 29th November it was 17·5 mm. long; on 30th November it prepared a cocoon and pupated on 1st December, the moth emerging on 9th December 1916.

The larva is occasionally greenish or brown, and the head may be reddish-brown.

The pupa is about 10·5 mm. long and 3 mm. broad, reddish-brown dorsally, yellowish ventrally, with the wing-sheaths reaching the fourth abdominal segment. Third and succeeding abdominal segments with three transverse dorsal ridges, first sharp and medially indented posteriorly to form a sharp angle, second ridge composed of four to eight rather large short spines, third ridge forming a posterior row of small, close-set, stout spines. The anterior

spineless medially recurved ridge is rather characteristic of the pupa of this species. (Y. Ramachandra Rao's *Lantana* Cage-slip 5.)

This species has also been reared at Pusa from larvæ sent from Solan in January 1916, as attacking orange leaves.

CACŒCIA ISOCYRTA, MEYR. MS.

A single larva was found at Pusa on 7th January 1917, in a rolled-up top of a lucerne plant, some of the top leaves being cut and dried and rolled up together. The moth emerged on 15th February. (Pusa Insectary Cage-slip 1914.)

CACŒCIA PENSILIS, MEYR. MS.

A single specimen was reared from a larva found boring into an orange fruit at the base of the stem; the fruit was purchased in Madras City, but was probably brought from some other locality in Southern India.

CACŒCIA COMPACTA, MEYR.

Cacœcia compacta, Meyr., Exot. Micr., II, 164-165 (1918)(1).

Bred at Pusa in February-March 1916, from larvæ found webbing up *Salix* leaves and feeding under cover of the webbing on the epidermis and mesophyll tissue of the leaves. The larvæ were collected on 29th February, when they were about half-grown and pupated between 21st and 27th March, the moths emerging from 26th March to 6th April 1916. Pupation took place within folded leaves, in a slight cocoon formed of white silken threads.

The half-grown larva is about 10 mm. long and 1 mm. broad, cylindrical, dull green with scattered short pale-greenish hairs, head shiny yellowish-brown, prothoracic shield black and strongly chitinized.

The full-grown larva is about 20 mm. long and 2 mm. broad, head pale brown, otherwise as above.

The pupa is about 10 mm. long and 2·5 mm. broad across the thoracic region, cylindrical, tapering posteriorly, anal segment produced and terminating in a pair of short aciculate processes, brown, darker dorsally and lighter ventrally with a slight green tinge over ventral thoracic region. (Tahl Ram's Cage-slip 170.)

CACŒCIA DISPILANA, WLK.

Pandemis dispilana, Wlk., XXX, 983 (1864) (1).
Cacœcia dispilana, Meyr., Cat. Tortric., p. 18 (1912) (2).
Archips mimicus, Wlsm., Swinh. Cat. Het. Oxf. Mus., II, 573 (1900) (3).

The larva is recorded(3) by Minchin, from examples found at Ootacamund, as "green, head brown, slightly hairy. Leaf-roller on honey-suckle. Pupa brown."

The moth occurs throughout India (? except the North-West) from the *Nilgiris and Wynaad to Bhutan and Assam and in Burma to Mergui.* We have it from Shillong and Cherrapunji.

CACŒCIA PHILIPPA, MEYR.

Cacœcia philippa, Meyr., Exot. Micr., II, 165 (1918)(1).

"Bred at Abbottabad from larva on *Hedera,* June (Fletcher) (1)."

ULODEMIS TRIGRAPHA, MEYR.

Ulodemis trigrapha, Meyr., B. J., XVII, 736 (1907)(1), B. J., XXII, 771 (1914)(2).

This species was originally described from Bhutan(1) and later recorded from the Khasi Hills(2). We have it from Darjiling and Shillong. At Shillong it was reared in October 1916, from a larva found feeding on the berries of an unidentified jungle shrub (? *Viburnum* sp.).

PANDEMIS RIBEANA, HB.

Tortrix ribeana, Hb., Samml. Eur. Schm., f. 114 (1800)(1).

Pandemis ribeana, Meyr., Handbk., p. 533 (1895) (2); Wlsm., A. M. N. H. (7), V, 386 (1900)(3); Kennel, Pal. Tortric., p. 157, t. 8 ff. 21, 22 (1910)(4).

This insect is a palæarctic species which occurs in North and Central Europe, Central Asia, the Himalayan Region, China, Korea, and Japan.

The larva feeds in more or less spun-up leaves of *Cratægus, Rosa, Prunus, Pyrus, Quercus, Rhamnus, Fraxinus, Sorbus, Acer, Tilia, Betula, Ribes, Berberis, Geum,* etc. It is described by Meyrick as "light green; dorsal line darker; head green, sometimes brown-spotted; plate of 2 green (2)."

TORTRIX SEMIALBANA, GN.

Cacœcia semialbana, Guenee, Ann. S. E. Fr., 1845, p. 139(1); Kennel, Pal. Tortric., pp. 142-143, t. 7 f. 45 (1910)(2).

Archips semialbanus, Wlsm., A. M. N. H. (7) V, 383-384 (1900)(3).

Larva on *Lonicera, Rosa, Chelidonium, Labium, Urtica,* etc.(2)

Another palæarctic species, which occurs along the Himalayan region from Kashmir to Sikkim. We have it from Dungagali (Hazara District; 8,000 feet) and Kasauli.

TORTRIX DUMETANA, TR.

Tortrix dumetana, Treitschke, Schmett. Eur., X (3), p. 160 (1835)(1); Meyr., Handbk., p. 538(2); Wlsm., A. M. N. H. (7) V, 451 (1900)(3); Kennel(3), Pal. Tortric., pp. 193-194, t. 10 f. 12 (1910)(4).

Larva in leaves or spun-up shoots of *Lonicera*, *Valeriana*, *Urtica*, *Sanguisorba*, *Origanum*, *Dictamnus*, *Hedera*, *Thalyctrum*, *Rubus*, *Umbelliferæ* and *Quercus*(4).

A palæarctic species, recorded(3, 4) from Kashmir.

HARMOLOGA MISERANA, WLK.

Teras miserana, Wlk., XXVIII, 301 (1863)(1).

Harmologa miserana, Meyr., P. Linn. Soc. N. S. W., XXXV, 270 (1910)(2), Entom. Mitteil., Suppl. No. III, p. 48 (1914)(3).

"Larva rather slender, cylindrical, with scattered whitish hairs; grey-whitish, posteriorly ochreous-tinged; two brownish-ochreous spots placed longitudinally on back of each segment; lateral line moderately broad, reddish-fuscous; head dark-fuscous; segment 2 whitish, posteriorly tinged with ochreous, posterior angles suffusedly blackish: feeds between joined leaves of *Ficus benjamina* and another *Ficus* not identified, rolling up a corner for shelter, in August (and doubtless most of the year); pupation in same position(2)."

The above description is from Australian examples. The insect occurs in Australia, Java, Formosa and Assam.

CNEPHASIA ARGENTANA, CL.

Phalæna argentana, Clerck, Icones 11, 14(1).

Tortrix argentana, Meyr., Handbk., p. 542(2); Kennel, Pal. Tortric., pp. 196-197, t. 10 ff. 17, 18(3); Wlsm., A. M. N. H. (7) V, 460(4); Durrant, P. Z. S., 1906, 498(5).

Recorded to occur in N.-W. India(3), Kashmir (7,000-13,000 ft.)(3, 4, 5) and Sikkim (15,000 ft.)(5).

PLANOSTOCHA CUMULATA, MEYR.

Cacœcia cumulata, Meyr., B. J., XVII, 977 (1907)(1).

Planostocha cumulata, Meyr., Exot. Micr., I, 13 (1912)(2), Wytsm. Gen. Ins. Tortric., p. 50, t. 3 f. 45 (1913)(3).

This species, originally described(1) from Ceylon and Coorg, we have from the Nilgiris, Sidapur (Coorg) and Yercaud (Shevaroy Hills).

At Sidapur it was reared from *Lantana camara* by Y. Ramachandra Rao, but no description of the early stages seems to have been made.

EBODA OBSTINATA, MEYR.

Eboda obstinata, Meyr., B. J., XVIII, 624 (1908)(1), Exot. Micr., I, 20 (1912) (2).

The larva is described(2), from Pusa records, as "slightly tapering posteriorly, green, with a lateral row of whitish hairs; subdorsal line

indistinct, whitish ; head yellow-green, in rolled leaves of *Cardiospermum* (Sapindaceæ)."

The moth is recorded from India (Pusa), Ceylon (Puttalam), Mauritius, the Comoro Islands, and S. Africa. We have it from Pusa only.

The larva either rolls a single leaf of *Cardiospermum* sp. (Hindi *Banchatail*) or spins together two or three leaves, inside which it hides and feeds on the leaves. It is about 12 mm. long, cylindrical, slightly tapering posteriorly, with two lateral rows of whitish hairs and an indistinct whitish subdorsal line running from mesothorax to anal segment ; thoracic legs slender, pointed ; prolegs short, the anal pair directed posteriorly. When about to pupate, the subdorsal line becomes more distinct and changes in colour from white to bay ; it extends from first to eighth abdominal segments ; the dorsal area between these lines becomes a brighter bay colour ; the eighth and ninth abdominal segments with two bay-coloured lateral dots.

Pupation takes place within a rolled leaf. The pupa is 6 mm. long tapering posteriorly, reddish-brown, wings green.

Larvæ were found at Pusa on 9th August, 1907. Pupation commenced on 13th August and the moths emerged between 20th and 24th August 1907. (A. Mujtaba's Cage-slip 30.)

PERONEA SIDEROTA, MEYR.

Peronea siderota, Meyr., Exot. Micr., II, 171 (1918)([1]).

"Bred at Peradeniya in December from larva mining in twigs of *Cinnamomum camphora* (Rutherford)([1])."

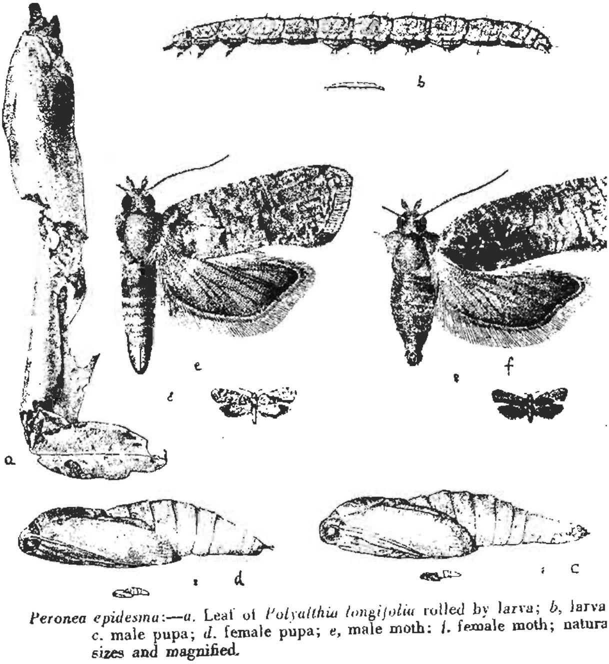
PERONEA EPIDESMA, LOW. (PLATE IX.

Polylopha epidesma, Lower, Tr. Roy. Soc. S. Austr. (1901) 71([1]).
Oxygrapha porpacias, Meyr., B. J., XVIII, 625 (1908)([2]).
Peronea epidesma, Meyr., P. Linn. Soc. N. S. W., XXXV, 292-293 (1910)([3]).

Recorded from Australia([1, 3]), Siam([2]) and Ceylon.([2, 3]). We have a long series from Pusa.

The larvæ have been found at Pusa on 29th October 1911, and 15th September 1917, rolling and binding together tender leaves of *Polyalthia longifolia* (Hindi *Asokh*). On the latter date they were found in very large numbers and were noted as doing considerable damage.

The larva is about 15 mm. long, rather flattened, tapering slightly towards either extremity, brownish grey sometimes with a greenish or dark tinge. Head shining pale yellow speckled with black. Prothoracic shield as head with a black collar-like bar posteriorly. Hairs as shown in figure d, their



Peronea epidesma:—*a*. Leaf of *Polyalthia longifolia* rolled by larva; *b*, larva c. male pupa; *d*. female pupa; *e*, male moth: *f*. female moth; natura sizes and magnified.

bases slightly tubercular. Spiracles rounded, narrowly ringed with brown. Tracheal tube white, thread-like, visible along line of spiracles. Five pairs of equally developed prolegs with hooklets disposed in a circle.

Pupation takes place in a thin white silken cocoon lining a rolled leaf. Before emergence, the pupa wriggles out to some extent through one end of the cocoon.

The pupa is from 8 to 10 mm. long, slightly compressed dorso-ventrally, tapering posteriorly, yellow brown. Abdominal segments with transverse rows of short spines bordering anterior margin and preceding posterior margin. The male pupa is longer than that of the female, the eighth and succeeding abdominal segments being elongated to accommodate the long anal claspers of the male moth. Anal segment without special armature but provided with a few thin circinate hairs.

From larvæ collected on 15th September 1917, moths emerged between 24th September and 5th October 1917, and between 22nd and 28th November 1911, from larvæ collected on 29th October 1911. (Pusa Insectary Cage-slips 920, 1703.)

[PERONEA SCHALLERIANA, LINN.

Tortrix schalleriana, Linn., Faun. Suec. No. 1339 (1761)(1).
Tortrix comparana, Hb., Samml. Eur. Schm., VII, t. 46, f. 284 (ante 1813)(2).
Oxygrapha comparana, Wlsm., Swinh. Cat. Het. Oxf. Mus., II, 572 (1900)(3).
Peronea schalleriana, Meyr., Cat. Tortric., p. 62 (1912)(4).

This is a European species, recorded(4) from North and Central Europe and Maine. Lord Walsingham has recorded it(3) from Ootacamund, where *the larva is stated to be very common, rolling up rose leaves* ; this is doubtless an error, perhaps for *extensana* Wlk., and *schalleriana* should be removed from the Indian list pending further evidence.]

EUCOSMIDÆ.

SPILONOTA RHOTHIA, MEYR.

Spilonota rhothia, Meyr., T. E. S., 1910, 368(1), Exot. Micr., I, 33 (1912)(2).

Originally described from Mauritius, India (Pusa) and Ceylon (Maskeliya)(1). Widely distributed in India. We have it (or I have seen specimens) from Pusa, Nagpur, Balaghat (C. P.), Coimbatore and Koilpatti.

Larva on *Psidium guava*(1). Described from Pusa records, it is cylindrical, slightly tapering posteriorly, bright orange ; head flattened, yellow ; spots yellow-whitish, with very fine white hairs ; segments constricted transversely in middle ; in rolled terminal portions of leaves of *Eugenia jambolana* (Myrtaceæ)(2).

This species was reared at Pusa at the end of March 1916, from small larvæ found on tender leaves of *Eugenia jambolana* on 10th March. One specimen of *Polychrosis cellifera* was also reared with these, but the larvæ were not distinguished. (Dwarka Prasad Singh's Cage-slip dated 10th March 1916.)

At Nagpur this species was said to have been reared from "balsam" and at Koilpatti it has been reared from a larva feeding on tender mango leaves.

ACROCLITA CHERADOTA, MEYR.

Acroclita cheradota, Meyr., B. J., XXI, 856([1]).

Strepsipleura cheradota. Lefroy, Ind. Ins. Life, p. 540 (1909)([2]).

Larva feeding in rolled leaves of *Ficus religiosa* at Pusa([1, 2]). Also recorded from Puttalam, in Ceylon([1]). We have specimens from Pusa and Coimbatore, in both cases bred from larvæ on leaves of *Ficus religiosa*, but no description of the larva seems to have been made. It has also been reared at Pusa from a larva found on *Ficus glomerata* in a gall caused by *Pauropsylla depressa*; the larva was found on 25th December 1916, and emerged on 14th January 1917.

ACROCLITA NÆVANA, HB.

Tortrix nævana, Hubner, Tortric., 261([1]).

Eudemis nævana, Meyr., Handbk., p. 477 (1895)([2]).

Rhopobota nævana, Wlsm., A. M. N. H. (7), VI, 441 (1900)([3]); Kennel, Spuler's Schmett. Eur., II, 273, t. 85 f. 43([4]).

Acroclita nævana, Meyr., B. J., XXI, 857 (1912)([5]).

Larva light grey-brown, sides more yellowish; head black or blackish-brown; plate of 2 black; on blackthorn, holly, *Vaccinium*, etc.([2]).

Occurs throughout India and Ceylon; also in Europe and Japan. We have this from the Khasi Hills, where it is common, but it has not been reared in India.

ACROCLITA VIGESCENS, MEYR. MS. (PLATE VIII, FIG. 2.)

This species has been reared at Pusa from pupæ found on 9th March 1916, on leaves of *Cordia myxa* and from larvæ found on 15th April 1916, joining together leaves of *Cordia latifolia*. The larva was described as pale brownish slightly tinged with green; head brown with brown mouthparts. The pupæ were found on either side of the leaf; in some cases the cocoon consisted of fine whitish silken threads only, in others blackish pellets of excrement were attached to the silk. On emergence of the moth the chestnut-brown pupa is protruded out of the cocoon. The moths emerged in

March and April. (C. S. Misra's Cage-slip dated 9th March 1916, and Ram Saran's Cage-slip dated 15th April 1916.)

ANCYLIS GLYCYPHAGA, MEYR.

Ancylis glycyphaga, Meyr., Exot. Micr., I, 32 (1912)(1).

The larva, described from Pusa records, is subcylindrical, yellow, head flattened ; feeds on the sugary excretion of *Phromnia marginella* (Homoptera) ; pupa in a white cocoon(1).

In January 1910, a number of living nymphs of *Phromnia marginella* was received and with them a few leaves which were covered with a thick, hard, dry crust of their sugary excretion. All of these were placed on a living *ber* (*Zizyphus jujuba*) plant and covered with a field-cage and later on these caterpillars were found in a hibernating condition inside their cocoons ; as all the caterpillars were found in the midst of the sugary excretion, which bore marks of having been nibbled, it was supposed that they had fed upon it. One of the caterpillars was parasitized by a dipterous grub which emerged from its host's pupa and then pupated inside the cocoon alongside this pupa.

The full-grown larva is about 15 mm. long, sub-cylindrical, segments distinct, integument soft, yellow ; head shiny yellow, flattened ; prothoracic shield large, yellow ; mesothoracic and metathoracic regions dark ; body with sparse thin hairs ; prolegs equally developed.

Pupation takes place in a white silken cocoon formed either in cracks in the crust of sugary *Phromnia* excretion on a leaf or on a leaf, preferably in a corner.

Pupa about 8 mm. long, brown, with two transverse rows of minute backwardly-directed spines on dorsal region of abdominal segments ; anal extremity rather blunt with several thin hairs with recurved tips around apex. The pupa emerges from the cocoon to some extent before the exit of the adult. (Pusa Insectary Cage-slip 821.)

We also have this from Abbottabad.

ANCYLIS CARPALIMA, MEYR.

Ancylis carpalima, Meyr., P. Linn. Soc. N. S. W., XXXVI, 244 (1911)(1), B. J., XXI, 861 (1912)(2).

Common in India and Ceylon, also occurring in Queensland(1).

ANCYLIS LUTESCENS, MEYR.

Ancylis lutescens, Meyr., Exot. Micr., I, 32 (1912)(1).

The larva, as described from Pusa records, is cylindrical, tapering posteriorly, greenish, towards extremities yellowish, with short scattered whitish

hairs; head rosy-yellowish; second segment with shining yellow semicircular lobes at anterior angles, not meeting dorsally; in rolled leaves of *Zizyphus jujuba* (Rhamnaceæ); pupa in cocoon in same position([1]).

Larvæ were found at Pusa on 26th September 1907, rolling up *ber* (*Zizyphus jujuba*) leaves and feeding on the epidermis of the upper surface of the rolled leaf, the lower surface of leaf (external surface of rolled portion) not being eaten. Young green leaves may also be eaten from the edge or in holes, but dry or partially dry leaves are not eaten.

Young larva about 9 mm. long, cylindrical, tapering posteriorly; light green, rather transparent, the visceral contents visible through the skin, anteriorly and posteriorly yellowish; head shiny yellowish with a rosy tinge; prothorax with shining yellow semicircular protuberant lobes at anterior angles, not meeting dorsally, with two lateral setigerous tubercles and smaller hairs on dorsal area; abdominal segments distinct, with whitish dorsal and lateral hairs, the latter projecting outwards; prolegs dull white. Full-grown larva about 30 mm. long, with irregular alternately brownish and light-green stripes along the back and sides.

The larva rolls up the edge of a leaf by means of silken threads and lives in the hollow thus formed within a thinly woven white silken network. It pupates in this chamber.

Pupa about 8 mm. long, cylindrical, blunt anteriorly, brown, abdominal segments dorsally with submarginal transverse rows of indented lines, first row behind anterior margin, second row before posterior margin and composed of finer indented lines than first row; cremastral hooks six in number, in two rows of three each. The anterior third of the pupa is protruded from the cocoon for emergence of the moth, the posterior extremity being attached to interior of cocoon by the cremastral hooks. The pupal period is seven days in October. Larvæ found on 26th September, emerged from 7th to 23rd October 1907. (Pusa Insectary Cage-slip 607.)

We have this from Pusa, Hoshangabad and Gauhati. It has also been bred at Pusa from larvæ in galls on *ber* branches and from a larva boring in *Blumea*.

ANCYLIS CYANOSTOMA, MEYR.

Ancylis cyanostoma, Meyr., Exot. Micr., II, 16-17 (Oct. 1916)([1]).

"Bred at Pusa in January from larvæ feeding in spun leaves of *Zizyphus jujuba*"([1]).

Larvæ rolling up *ber* (*Zizyphus jujuba*) leaves and collected at Pusa on 26th December 1915, emerged between 27th January and 14th February 1916, one of the resultant moths being *Ancylis lutescens* and the rest

A. cyanostoma. No description of the early stages seems to have been taken. (Tahl Ram's Cage-slip 130.)

DIPLONEARCHA INSINUANS, MEYR.

Diplonearcha insinuans, Meyr., Exot. Micr., I, 274-275 (1914)(1).

Reared from Psyllid gall on *Ficus* at Peradeniya(1).

EUCOSMA CRITICA, MEYR.

Eucelis critica, Meyr., B. J., XVI, 587 (1905)(1); Lefroy, Ind. Ins. Pests, p. 143 (1908)(2), Ent. Mem. Dept. Agric. India, I, 221(3), Ind. Ins. Life, p. 530, t. 55 (1909)(4); Fletcher, S. Ind. Ins., p. 450, t. 39 (1914)(5), Proc. Second Entl. Meeting, pp. 12, 42 (1917)(6).

Eucosma ludicra, Meyr., B. J., XXI, 867 (1912)(7).

Eucosma trichocrossa, Meyr., Exot. Micr., I, 563-564 (1916)(8).

Laspeyresia trichocrossa, Fletcher, Entl. Note 76 (1916)(9).

This polynomial species, originally described(1) from specimens bred from larvæ in spun-up shoots of *Cajanus indicus* at Surat, has since been recorded* from North Coorg(7), Southern India(5) and Pusa(9) and it probably occurs throughout the Plains of India. We have it from Pusa, Surat and Coimbatore. Hitherto it has only been noticed to attack *Cajanus indicus*, of which it is a minor pest, the larva rolling and webbing together the top-leaves of its foodplant and also eating into flower-buds and boring into pods and devouring the seeds. At Pusa this species is active from March to May and again from August to October, hibernating in the larval state. The following is a summary of the life-history as noted at Pusa :—

The egg is elongate with rounded ends, about 0·5 mm. long and 0·25 mm. in diameter. When laid it is of a creamy white with a greenish tinge but later on turns yellow and small reddish patches, usually forming two interrupted reddish longitudinal markings, appear on its surface. Eggs are laid at night and singly ; when several are laid close to one another they are usually placed in a row. They may be laid on any part of the foodplant—on the upper or lower surfaces of leaves, on petioles of leaves, or on the stem—but a groove or depression is always preferred as a suitable place for oviposition ; thus, on the upper surfaces of leaves most eggs will be found on a midrib or vein whilst on lower surfaces of leaves they will be found placed beside a midrib or vein, and the grooves of petioles or peduncles are very favourite places. A female moth, which emerged on 5th October, laid in confinement

* It has also been recorded from other localities (*e.g.*, Nagpur and Raipur) but it is doubtful how far some of these records really refer to *E. critica*.

26 eggs on 7th, 34 on 8th, 29 on 9th, 13 on 10th, and died on 11th October, having laid 102 eggs in all. Of these 102 eggs, 31 were laid on the stem, 21 on the grooves of petioles or peduncles of leaves, 26 on the upper and 24 on the lower surfaces of leaves. The egg-stage lasts about three days, the larva gnawing a hole at one end and bursting open the egg-shell longitudinally. The empty egg-shell is not eaten.

The newly-hatched larva is about 1 mm. long, cylindrical, tapering slightly posteriorly, uniformly yellow, with five pairs of fully developed prolegs; head black, shiny, larger than following segments; prothoracic shield small, shining dark brown. The larva changes but little in colour as it grows.

The full-grown larva is about 10 mm. long, cylindrical, slightly tapering towards either extremity, yellowish, with a few scattered hairs on each segment; head smaller than prothorax, shiny yellow, somewhat compressed, mouthparts brown, with two small black spots laterally and a third near antenna, ocelli arranged in a crescent; prothoracic shield shiny, brownish yellow; legs yellow; spiracles rounded, rimmed with brown.

The larva on hatching usually comes to the tender top-leaves if it does not happen to have emerged there. When these leaves are still in a folded state, it burrows into one of them and feeds from within. If the leaves have already unfolded, it begins to gnaw a midrib and the adjacent tissue on the upper surface of a leaf and soon hides itself under a very thin transparent, gummy stuff, to which dust-like gnawed particles of the leaf remain attached and which stretches over the midrib and larva onto the two halves of the leaf; it works upwards until the two halves of the leaf become folded together. During its whole life, the larva remains hidden, whether feeding on leaves, flowers, or pods. As it grows it brings together almost all the top-leaves of a shoot or of adjacent shoots and binds them together in a crumpled mass, within which it feeds and lives. These spun top-shoots are fairly conspicuous and their removal is indicated as a means of control. At Pusa hibernation takes place in the larval state, as full-grown larvæ, collected from the fields on 7th January, lived in spun-up leaves until 18th February, when the first pupated and emerged as a moth on 6th March.

Pupation takes place in a thin, papery, whitish, silken cocoon which usually lines a hollow space within a crumpled mass of spun leaves. It may, however, be placed inside a flower-bud or within a few dried flower-petals rolled together or, when the larva has fed in a seed-pod, inside the pod, in which case a hole of exit is prepared for the moth, this hole being covered with silk and frass. Before emergence, the pupa wriggles out of the cocoon for about half its length. The pupal period is about four to six days.

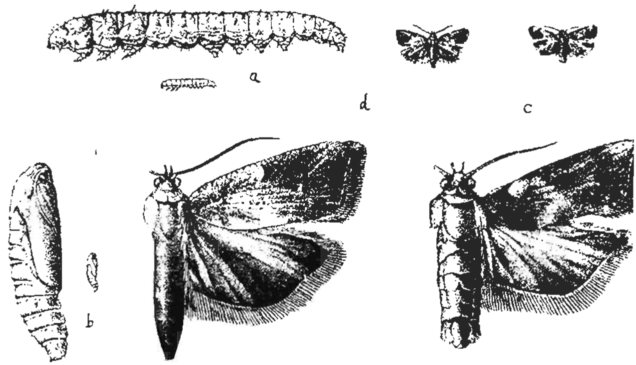


Fig. 1. *Eucosma melanaula*:—*a*. Larva; *b*, pupa; *c*, male moth; *d*, female moth; natural sizes and magnified.

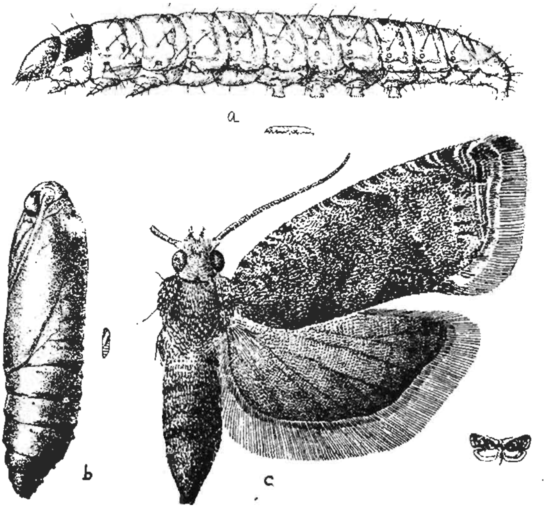
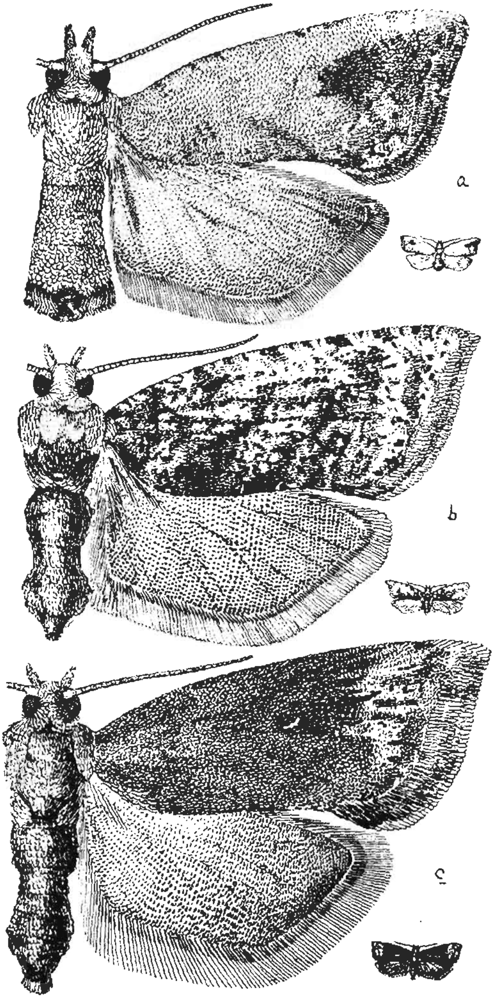


Fig. 2. ***Eucosma conciliata*** **:—*a*, Larva ; *b*, pupa ; *c*, moth, natural sizes ai magnified.**



Eucosma melanaula.—Three varieties of Moth (x 10):—*a*, male; *b*, and *c*, *females*.
(Note black glandular patch on hind wing of male.)

The pupa is about 6 mm. long, tapering posteriorly, but rather blunt at anal extremity, yellow brown; abdominal segments dorsally with a row of small embossed points transversely across their anterior portion; anal segment with six white cremastral hairs.

The life-cycle is shown in the following table :—

Eggs		Larvæ pupated	Moths emerged	To duration
Laid	Hatched			
23 August	26 August	8 September	14 September	22
11 September	14 September	27 September	2 October	21
12 September	15 September	28 September	3 October	21
14 September	17 September	30 September	4 October	20

EUCOSMA MELANAULA, MEYR. (PLATE X, FIG. 1; AND PLATE XI.)

Eucosma melanaula, Meyr., Exot. Micr., II, 17-18 (Oct. 1916)(1).

Described from the Khasi Hills, Pusa and Coimbatore, and doubtfully from Java. "Bred from larvæ feeding in flowers or pods of *Cajanus indicus* and *Phaseolus mungo* (Leguminosæ)"(1). We have it from Pusa, Chapra and Coimbatore.

Eucosma melanaula, although only recently distinguished, is of common occurrence, probably throughout India, on various leguminous crop-plants. It has been found at Pusa on *arhar* (*Cajanus indicus*), *urid* (*Phaseolus radiatus*), *mung* (*P. mungo*), *moth* (*P. aconitifolius*) and Florida beggar-weed, the larva boring into flower-buds, flowers, top-shoots and seed-pods. In the case of pods, the seeds are eaten, and, when top-shoots are attacked, the larva tunnels to some distance even in the case of thick stems, the stem being killed back and the top leaves also being webbed over and eaten. In the case of flowers, they are spun together with silk and the larva lives concealed amongst the spun-up flowers. It is at times a decided pest and seems to occur at any suitable time of the year but in greatest numbers from August to October.

The full-grown larva is about 11 or 12 mm. long and 1·5 to 2 mm. broad, moderately stout, somewhat compressed dorso-ventrally, sides of body nearly parallel, uniformly yellow, occasionally greenish; head shiny yellow, yellow-brown or occasionally blackish; prothoracic shield unicolorous with head or paler; body segments distinct, tubercles show as somewhat shiny spots carrying thin hairs; legs and prolegs normal, unicolorous with body, hooklets on prolegs brown and arranged in a complete circle.

Pupation takes place within a white silken cocoon formed amongst spun-up top-leaves or between super-imposed blades of an older leaf, amongst spun-up flowers, or near the mouth of the tunnel in a bored pod. The pupal period is from five to eight days at the end of September. Before emergence, the pupa wriggles out through one end of the cocoon to some extent.

The pupa is about 6 to 7·5 mm. long and 1·5 to 2 mm. broad, cylindrical, brown, anal extremity rather obtuse; abdominal segments with a transverse row of short black spines extending across dorsum from spiracle and another similar but faintly-developed row across posterior portion of segments; anal segment dorsally armed with six upturned black spines. (Pusa Insectary Cage-slips 517, 611, 1644, 1689, and 1694.)

The coloration of the imago is very variable, some of the more common forms being shown in the figures.

EUCOSMA BALANOPTYCHA, MEYR.

Eucosma balanoptycha, Meyr., Rec. Ind. Mus., V, 218(1), Exot. Micr., II, 18(2).

Originally described from Maskeliya, Puri and Konkan(1). Since reared at Coimbatore on leaves of *Pongamia glabra* (Leguminosæ)(2) in October 1914. We have it from Coimbatore (larva on *Pongamia* leaves) and from Ahmedabad (reared from larva eating galls on *Pongamia glabra* leaf).

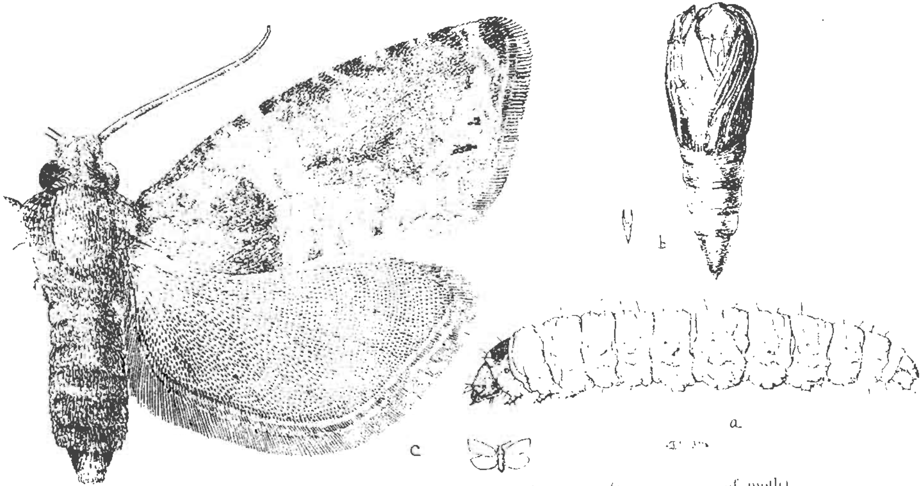
EUCOSMA CLEPSIDOMA, MEYR.

Eucosma clepsidoma, Meyr., Exot. Micr., II, 18 (Oct. 1916)(1).

"Bred at Coimbatore in April from galls on an unidentified plant (*Fletcher*)"(1).

EUCOSMA CONCILIATA, MEYR. MS. (PLATE X, FIG. 2.)

Larvæ were found at Pusa on 20th March and 20th April 1917, feeding on the flowers of *palas* (*Butea frondosa*). Some of the petals of the flowers, *viz.*, the wings and the keel, are joined towards their bases and the larvæ are usually found boring the thick conjoined parts, and they pupate in these parts in a sort of silken cocoon. The larva, when full-grown, is about 11 mm. long and 1·5 mm. broad across mid-body, slightly flattened, tapering towards either extremity, uniform pale yellow, the dorsal vessel showing through the skin and the primary tubercles looking like small brown points (under a lens); head smaller than prothorax, rather dark brown, shiny; prothoracic shield medially divided, concolorous with head; five pairs of equally developed prolegs. The pupal period in April is about six days. (Pusa Insectary Cage-slip 1536.)



Eucosma zelota:—*a*, Larva (×10) ; *b*, pupa (after emergence of moth) (×8) ; *c*, moth (×13).

EUCOSMA FŒNELLA, LINN.

Tinea fœnella, Linn., Syst. Nat. ed. X, p. 536 (1758)([1]).

Epiblema fœnella, Meyr., Handbk., pp. 496-497 (1905)([2]); Kennel, Spuler's Schmett. Eur., II, 283, t. 86 f. 26 (1910)([3]).

Eucosma fœnella, Wlsm., A. M. N. H. (7), VI, 340 (1900)([4]).

A palæarctic species, ranging from Europe to Armenia, China, Korea and Japan, and recorded from Dharmsala([4]).

Larva yellow-whitish; head dark-brown; plate of 2 brownish ochreous; in stems and roots of *Artemisia vulgaris*. The larva is figured by Spuler([3]) (Nachtr., Taf. X f. 29).

EUCOSMA ZELOTA, MEYR. (PLATE XII.)

Eucosma zelota, Meyr., Exot. Micr., II, 18 (Oct. 1916) ([1]); Proc. Second Entl. Meeting, p. 264 (1917)([2]).

Described from Abbottabad, where the larvæ were found on 10th June 1916, spinning together three or four young rose leaves into a bunch. The leaves (or at least two of them) are folded longitudinally and the larva feeds inside the leaves, passing from one to another through communication-passages. The whole interior part of the folded leaves is thickly lined with white silk.

The full-grown larva is about 9 mm. long, moderately stout, cylindrical, rather flattened, pale brownish yellow or orange-yellow or dirty greenish-yellow, the contents of intestinal canal clearly visible through the skin; head shining black; prothoracic shield distinctly divided medially, shining black; legs black; prolegs yellowish; lateral flange well defined; body segments with scattered short whitish hairs arising from minute black warts.

Pupation takes place in a silken cocoon formed inside the bunch of spun leaves. Moths emerged between 16th and 25th June 1916.

EUCOSMA STEREOMA, MEYR.

Eucosma stereoma, Meyr., Exot. Micr., I, 33-34 (1912)([1]).

Larva, described from Pusa records, is cylindrical, greyish-yellow; head flattened, yellow; plate of second segment large, yellow; spots with longish white hairs; in rolled terminal leaves of *Acacia* sp. (Leguminosæ); pupa in a white cocoon([1]).

Eucosma stereoma was reared at Pusa in April 1911, from larvæ found in rolled-up flowers of *Pithecolobium dulce* or *Inga dulcis*, and again on 2nd and 4th August 1911, from larvæ found on 24th July rolling the top-leaves of a species of *Acacia*, living hidden and feeding on the leaves from within its tube. It pupates amongst the leaves in a white silken cocoon.

Larva about 8 mm. long, cylindrical, tapering very slightly posteriorly; head flattened, yellow; prothoracic shield large, yellow; body soft, uniformly greyish-yellow, segments moderately distinct, with longish white hairs arising from shiny chitinized plates concolorous with body; prolegs equally developed.

Pupa about 5 mm. long, cylindrical, tapering posteriorly, anal segment with yellowish cremastral hooks; abdominal segments anteriorly with a transverse row of small spinous processes across dorsal area. (Pusa Insectary Cage-slips 880, 910.)

EUCOSMA MELANONEURA, MEYR.

Eucosma melanoneura, Meyr., B. J., XXI, 866 (1912)(1).

Only known from the Khasi Hills(1).

The larvæ of this species are abundant at Shillong in September, spinning up the flowers of *Rhus semialata* into little knots and feeding on the flowers under cover of a silken tube covered with fragments of the flowers. The attacked flower-heads are quite conspicuous and in many cases practically every flower is destroyed. Pupation takes place within the larval galleries, the moths emerging towards the end of September and in October.

CROCIDOSEMA PLEBEIANA, Z.

Crocidosema plebeiana, Zeller, Isis, 1847, pp. 721-722(1).

Crocidosema plebeiana, Wlsm., P. Z. S., 1907, 1001-1002 [*synonymy*](2); Meyr., P. Z. S., 1908, 720(3); Willcocks, Ins. Pests Egypt, I, i., 320-321, t. vii ff. 5, 6 (1916)(4).

Eucosma plebeiana, Meyr., Tr. Linn. Soc. (2) XIV, 268 (1911)(5), Entom. Mitteil., Suppl. III, p. 48 (1914)(6).

This species is widely distributed around the Mediterranean Region(1, 2, 4), St. Helena(2), West Indies(2), Central and South America(2), Australia(2) and Hawaii(2), and has also been recorded from Pundaluoya in Ceylon(2) and is doubtless of common occurrence throughout India.

Larva on *Althæa, Lavatera, Malva* and allies(4).

Willcocks(4) gives the following description of the early stages :—

" *Egg*. The eggs are laid singly on the seed capsules or fruits and flower-buds of the ornamental hollyhock (*Althæa* sp.) ...... The egg ...... is ...... 0·6 mm. long by 0·36 mm. wide; it is oval in form, convex, and the shell is very rugose in appearance. The colour is pale at first and then a horse-shoe-shaped irregular line of scarlet becomes visible and this may gradually spread until the whole egg becomes red or orange-red in colour. Before hatching the egg again becomes pale with dark spot at one end formed by the head of the young larva and a pinkish or reddish line along one side.

" *Larva.* The larvæ feed on the green unripe seeds or in the undeveloped flower-buds. When full-grown the larva measures about 12 mm. in length and is green in colour with a brownish head.

" *Pupa.* The pupa (Plate VII, fig. 6) is found in the damaged seed capsules. In general appearance it is not unlike the pupa of the pink bollworm [*Platyedra gossypiella*], but with the aid of a magnifying glass it can be readily distinguished from the latter by the dorsal row of thorn-like projections on the basal margin of the abdominal segments and there is also a median row of these spines, but the latter are much smaller and less conspicuous than the others."

Mr. Willcocks also states that he found on a green cottonboll an egg which he believed to belong to *C. plebeiana*, but he failed to rear the larva.

[BACTRA LANCEOLANA, HB.

Tortrix lanceolana, Hubner, Samml. Eur. Schm., VII, t. 13 f. 80 (1797)(1).
Bactra lanceolana, Wlsm., A. M. N. H. (7). VI, 333-334 (1900)(2); Meyr., Pr. Linn. Soc. N. S. W., XXXVI, 253 (1911)(3).

This species, whose larva feeds on rushes (as probably do most of those of the described Indian species), has been recorded from India(2) but doubtless in error(3), and should be removed from the Indian list.]

BACTRA TRUCULENTA, MEYR.

Bactra truculenta, Meyr., B. J., XIX, 586 (1909)(1).

Originally described from North Coorg(1), we have this from the Palni Hills, Coimbatore, Pusa and Peshawar. At Pusa and Coimbatore it has been reared from larvæ feeding in stems of *Cyperus rotundus*.

POLYCHROSIS FETIALIS, MEYR.

This species has been reared at Pusa from a larva found feeding in a flower-head of *Leucas* sp.

POLYCHROSIS CELLIFERA, MEYR.

Polychrosis cellifera, Meyr., B. J., XXI, 869-870 (1912)(1).

Originally recorded from Colombo(1) and Pusa(1), this species has been reared at Pusa at the end of March 1916, from larvæ found on tender leaves of *Eugenia jambolana* on 10th March. Only one specimen was reared, together with three of *Spilonota rhothia*, and the larvæ were not distinguished. (Dwarka Prasad Singh's Cage-slip dated 10th March 1916.)

LOBESIA ÆOLOPA, MEYR.

Lobesia æolopa, Meyr., B. J., XVII, 976 (1907)([1]), P. Z. S., 1908, 716([2]), Exot. Micr., I, 565 (1916)([3]).

Originally described from Maskeliya and Peradeniya, in Ceylon, and from Bombay([1]), this species has also been recorded from Cape Colony([2]) and Reunion([3]). It seems to be widely distributed in India and Burma, the Pusa collection containing examples from Pusa, Coimbatore, Pollibetta, Mercara, Bangalore, Shillong and Moulmein.

In Ceylon it was bred by Rutherford from *Cajanus indicus*([3]).

Lobesia æolopa has been bred at Coimbatore and Mettupalayam by Y. Ramachandra Rao from larvæ webbing flowers and leaves and feeding on fruits of *Lantana camara*. The pupal period in December and January is from seven to ten days.

The full-grown larva is described by Ramachandra Rao as about 8 mm. long, dark brown or clay brown with a tinge of green in some segments ; head shiny dark brown tinged with yellow ; prothoracic shield less shiny than head over whose posterior part it fits like a hood. semi-circular, broader than head, somewhat roughened ; body segments twice breadth of head, each segment with several (usually about three pairs dorsally, four pairs laterally and a few ventrally) prominent yellowish-white shields which carry short setæ ; legs normal, blackish brown ; prolegs normal.

It has also been reared at Pusa from larvæ found in the flowers of *Leucas cephalotes* on 14th December 1915, the moths emerging between 8th January and 24th February 1916.

LOBESIA GENIALIS, MEYR.

Lobesia genialis, Meyr., B. J., XXI, 869 (1912)([1]).

This species was originally described from Peradeniya([1]) but seems to be widely distributed in Southern India, and we have it from Coimbatore, the Anamalai Hills, Bangalore and Sidapur (Coorg).

This species has also been bred at Coimbatore by Y. Ramachandra Rao from larvæ webbing flowers of *Lantana camara*. The larva is distinguishable from that of *L. æolopa* by its greenish colour. The eggs, laid on 23rd-24th December 1916, hatched on 27th December, a larva pupated on 10th January, and a moth emerged on 19th January 1917, so that the whole life-cycle occupies about four weeks. The stages are described by Ramachandra Rao as follows :—

The egg is about 0·5 mm. in diameter, opalescent yellowish, very much flattened and very irregular in outline ; when laid it is probably semi-fluid and adapts itself to the surface on which it is laid. Under a low magnification

PLATE XIII.

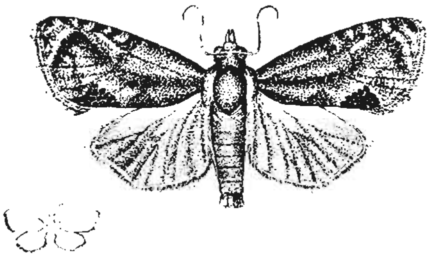


Fig. 1. *Argyroploce illepida.*

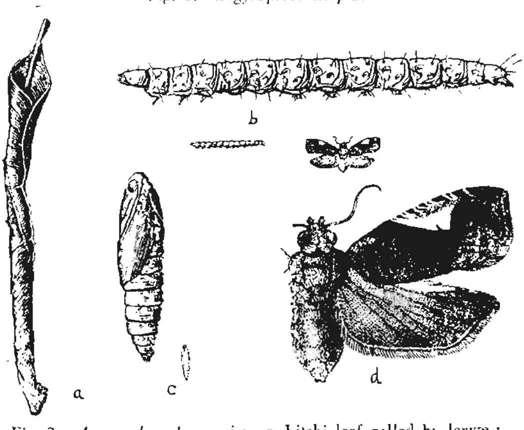


Fig. 2. *Argyroploce leucaspis*:—*a*, Litchi leaf rolled by larvæ ; *b*, larva ; *c*, pupa ; *d*, moth (x 5).

the surface of the eggshell appears to be reticulated, but under a higher power this reticulation is resolved into an exquisitely beautiful combination of many-rayed stellar ridges. In nature the egg is laid on leaves, leaf-buds, tops of flower-buds, or on fruits.

The newly-hatched larva is about 1 mm. long, cylindrical, creamy yellow, covered with short hairs; head large, flattened, shiny black; prothoracic shield flattened, light brown. A week after hatching it is 6·5 mm. long, head with a lateral brown streak, prothoracic shield margined with black, brown posteriorly.

The full-grown larva is about 9 mm. long, green, or yellowish-green, with prominent stiff setæ; head yellowish with a black lateral streak; prothoracic shield yellowish bordered with black except anteriorly.

Pupation takes place within a silken cocoon formed within a folded edge of a leaf. Pupal period about eight days.

Pupa 6 mm. long and 1·5 mm. broad across metathorax, rather slender, gradually tapering posteriorly, greenish brown, anal segment with five or six hairs with recurved tips. Posterior margin of each abdominal segment distinctly raised above anterior edge of its successor, each segment armed anteriorly and posteriorly with a submarginal transverse row of spines, composed anteriorly of rather large stout spines directed posteriorly, posterior row of much smaller, but far more numerous and more closely-set, denticles.

ARGYROPLOCE CITHARISTIS, MEYR.

Argyroploce citharistis, Meyr., B. J., XIX, 595 (1909)[1], Rec. Ind. Mus., V, 219[2].

This species is known from Moulmein[1], the Khasi Hills[1], North Coorg[1] and Quilon (Travancore)[2]. It is now recorded from Pusa where it was reared from a larva feeding in flower-heads of *Leucas* sp.

ARGYROPLOCE ILLEPIDA, BUTL. (PLATE XIII, FIG. 1.)

Teras illepida, Butl., T.E.S., 1882, 42[1].

Cryptophlebia carpophaga, Wlsm., I.M.N., IV, 106, t. 7 f. 1 (1899)[2]; Lefroy, Ind. Ins. Life, p. 531, t.28 ff. 11, 12 (1909)[3].

Cryptophlebia illepida, Wlsm., Fauna Hawaii, I 681, t. 10 ff. 23-25[4].

Argyroploce illepida, Meyr., Rec. Ind. Mus., V, 218[5], Pr. Linn. Soc. N.S.W., XXXVI, 265 (1911)[6], Tr. Linn. Soc.(2) XIV, 269 (1911)[7]; Fletcher, South Ind. Ins., pp. 449-450, f. 327 (1914)[8], Proc. Second Entl. Meeting, pp. 230, 234, 257 (1917)[9].

Widely distributed throughout India and Ceylon, having been recorded from Calcutta[2, 3], Pusa[9], Gujarat[9] and Southern India[8]. Also found

in South Africa(6), the Seychelles(7), Australia(5, 6), and Hawaii (1, 4, 5). We have it from Undugoda, Coimbatore, Surat, Pusa and Chapra.

Larva recorded in fruits of *Cassia*, *Feronia*, and *Nephelium*(7).

Lefroy(3) has given good figures of the larva and notes that it is found commonly in Gujarat, boring in the pulp of fruits of wood-apple (*Feronia elephantum*) and when full-fed preparing in the fruit a silken excrement-covered cocoon, from which the moth emerges after a week.

A. illepida was originally described from India by Lord Walsingham(2) under the name of *Cryptophlebia carpophaga*, from examples reared in Calcutta from pods of *Cassia fistula* and *C. occidentalis*, the male and female moths, larva and pupa-case being figured.

These figures of the larva and pupa-case were reproduced in *South Indian Insects*(8), where a new figure of the moth was also given and tamarind (*Tamarindus indica*) added to the list of foodplants.

Litchi fruits, when available, seem to be a very favourite food of the larva and it has been found in these fruits at Pusa in 1907, 1911, and 1914 and probably occurs every year, although in some years it is far more abundant than in others. Thus, I. H. Burkill notes that in May 1901, ninety-nine per cent. of the litchi fruits in the Calcutta market were tenanted by these larvæ which eat the funicle or stalk of the seed and bore into the seed itself; the funicle, being the way by which food passes to the seed, is probably highly nutritious as long as growth is actively going on and in it the larva tunnels until the fruit is perfectly ripe when the larva leaves it and emerges by biting through the wall at the base close to the stalk, and then spins its cocoon in some convenient crevice.

Besides the foregoing foodplants, *A. illepida* has also been reared at Pusa from *dhaincha* (*Sesbania aculeata*) pods and from *bael* (*Ægle marmelos*) fruits; at Coimbatore from pods of *babul* (*Acacia arabica*) and *agathi* (*Sesbania grandiflora*); and at Sabour in April 1917, from pulp of a purchased orange fruit. In the case of *dhaincha* a few pods were found bored in November 1917, the larvæ being found wholly within the pod, feeding on the green seeds, the frass being extruded through a hole in the side of the pod; only a few larvæ were found and the damage done was negligible. In the case of *bael* several larvæ were found on 29th November 1913, eating the pulp of a fruit which showed little sign of attack from the outside except for a few small holes and a small crack in the hard shell of the fruit. In the case of tamarind the larvæ bore into the seeds.

It cannot be said, however, that *A. illepida* is much of a pest as a rule. Even in the case of a high infestation of litchi fruits, comparatively little damage is done to the fleshy edible portion of the fruit.

The full-grown larva is about 15 to 19 mm. long and 2 to 3 mm. broad across the thorax, cylindrical, tapering slightly posteriorly, segments distinct, skin soft and smooth, colour rather variable, usually light yellow, darker dorsally, sometimes greyish with a yellow tinge, pinkish brown, reddish, or pale yellow with a greenish tinge; head broad, shiny reddish-brown; prothoracic shield large, shiny dark-brown, divided medially; tubercles rather large, rounded, brownish or yellowish, each bearing a single thin brown hair; anal plate large, dark brown, rather glossy; spiracles oval with a black rim enclosing a clear space; a whitish tube connecting spiracles visible beneath the skin; legs and prolegs normal; prolegs pale yellow, hooklets brown, disposed in a circle.

Pupation takes place either within the attacked fruit (*dhaincha, bael*) or outside of it (*litchi*) in a thin white silken cocoon which either lines the interior of the larval gallery, one end of the cocoon being near an exit hole which is covered with frass, or which is spun up in any convenient crevice. At emergence of the moth, which takes place seven to fourteen days after spinning up, the pupa is almost wholly protruded from the cocoon.

The pupa is about 8 mm. long and 2 mm. broad, cylindrical, tapering posteriorly, both extremities rounded, yellow-brown; second to seventh abdominal segments dorsally with two transverse rows of spines, one on anterior, the other on posterior, portions of segments; eighth and ninth abdominal segments with only one transverse row of spines dorsally; anal segment with about eight cremastral hooks. (Pusa Insectary Cage-slips 537, 898, 1019, 1064 and 1738.)

ARGYROPLOCE APROBOLA, MEYR.

Eccopsis aprobola, Meyr., T.E.S., 1886, 275([1]).
Platypeplus aprobola, Wlsm. in Moore, Lep. Ceylon, III, 495, t.208 f.z (1887)([2]).
Argyroploce aprobola, Meyr, Rec. Ind. Mus., V, 218 ([3]) Pr. Linn. Soc. N.S.W., XXXVI, 275 (1911)([4]), Tr. Linn. Soc. (2) XIV, 269 (1911)([5]), Entom. Mitteil. Suppl. III, p. 49 (1914)([6]); Proc. Second Entl. Meeting, pp. 219, 230, 267 (1917)([7]).

Occurs commonly throughout India and Ceylon, ranging to the Seychelles([3, 5]) and Amirante Islands([5]), Chagos Islands([5]), Formosa([6]), New Guinea([4]), Queensland([4]) to Tonga([1, 5]) and Tahiti([2]).

We have it from Pusa, Chapra, Palamau, Bassein Fort (Bombay), Surat, Kallar, Coimbatore and Pollibetta (South Coorg).

At Coimbatore the larva has been found boring into rose buds and rolling mango leaves, at Kallar (Nilgiris) on *Lantana camara*, at Bassein Fort on mango and is said to have been reared at Nagpur on Dahlia flowers(?), whilst at Pusa it has been reared from larvæ found rolling young leaves of mango (*Mangifera indica*), litchi (*Nephelium litchi*), rose, *Cassia tora*, and *asokh* (*Polyalthia longifolia*). Sometimes the larvæ occur in considerable numbers and may do a little damage to the young leaves.

The full-grown larva is about 16 to 20 mm. long and 2 mm. broad, cylindrical, rather flattened. tapering slightly towards extremities, rather transparent uniform green or pale yellow; head flattened, red-brown, brownish or yellowish; prothoracic shield large, darker than head; spiracles small, rounded, rimmed with brown; body segments with small dull white hairs; first twc pairs of legs black, third pair green or yellow; prolegs with very minute hooklets.

The larva rolls up tender leaves, feeding on them from under shelter Pupation takes place inside a rolled leaf which is lined by a thin layer of whit silk. Nearly the whole of the pupa is protruded from the cocoon on emergenc of the moth, which occurs after a pupal period of about ten days.

Pupa about 10 mm. long, cylindrical, tapering posteriorly, brown; dors portion of abdominal segments with two transverse rows of posteriorly-directe short spines; anal segment with four cremastral hooks which are entangl in the silken lining of the cocoon. (Pusa Insectary Cage-slips 600, 809, 9 1302, 1448, 1691 and 1750.)

ARGYROPLOCE CENCHROPIS, MEYR. MS.

Larvæ were found at Pusa on 11th June 1917, in fruits of *lashora* (*Cor myxa*), the attacked fruits showing no external symptom of attack. larvæ seem to feed upon the kernel, gnawing a hole through the wall of stone. Four larvæ were found in about one hundred fruits examined. larva is about 10 mm. long, white; head yellow or brownish yellow; pro racic shield brownish; five pairs of short, equally developed prolegs. P tion occurred in a silken cocoon spun on the bottom of the cage under a fruit. One moth emerged on 28th June. (Pusa Insectary Cage-slip 1595

ARGYROPLOCE EBENINA, MEYR.

Argyroploce ebenina, Meyr., Exot. Micr., II, 20 (October 1916)(1).

Bred at Karwar, N. Kanara, "in July from larvæ feeding gregari between spun leaves of *Diospyros* (Ebenaceæ); larva dark greenish-fu with whitish hairs, head brown, plate of 2 black; pupa beneath folded

ARGYROPLOCE EROTIAS, MEYR.

Platypeplus erotias, Meyr., B.J., XVI, 584-585 (1905)([1]).

Argyroploce erotias, Meyr., Proc. Linn. Soc. N.S.W., XXXVI, 269 (1911)([2]); Fletcher, Entl. Note 75 (1916) ([3]), Proc. Second Entl. Meeting, p. 219([4]).

This species was originally described from Ceylon([1]) and has since been recorded from New Guinea([2]), Timor([2]) and India([3, 4]). We have it from Pusa, Bombay, Kallar, and Kandy. At Bombay the larva was found boring into mango shoots.

Argyroploce erotias "has been reared at Pusa from larvæ found feeding on tender mango leaves in March 1912. The larva is about 16 mm. long by 2 mm. broad, slightly flattened, tapering towards the extremities, in colour uniform green, the skin soft and segments distinct; head flattened, greyish yellow, smaller than prothorax which is entirely covered by a shield darker than the head; all legs present and equally developed. The larva rolls up the tender leaves of young mango shoots by means of white silk threads, living in hiding and biting holes in the rolled leaves. When full-fed, it pupates in a cocoon formed of rolled leaf lined with white silk; the pupa is protruded to some extent before emergence of the moth. We also have specimens reared in October 1905, from larvæ boring mango shoots in Bombay([3])."

This species has also been reared at Pusa in February 1915, from larvæ webbing tender leaves of *Loranthus* sp. and in December 1915, from leaves of *Cynoglossum* sp.

Argyroploce erotias has also been reared by Y. Ramachandra Rao at Kallar from a pupa found in a folded leaf of *Lantana camara*.

This pupa was described as follows:—8·5 mm. long and 2·5 mm. broad, yellowish or reddish brown, rather shiny, rather slender, cylindrical, anteriorly blunted; frontal part of head with a prominent raised flat ridge bounded on each side by depressions from which the antennæ arise; anal segment conical terminating in a slightly flattened heavily chitinized red-brown apex bearing six or eight strong recurved hooks; abdominal segments anteriorly with a submarginal sharply excised ridge, following close upon which is a row of strongly developed posteriorly-directed spines (with a few smaller spines interspersed in some cases), and posteriorly with an ante-marginal transverse row of smaller but well-developed and more numerous spines; second segment of abdomen on each side with a subdorsal prominently-marked shallow pit guarded by strongly-developed chitinous red-brown lips; wing-sheaths extending to middle of fourth abdominal segment.

ARGYROPLOCE LEUCASPIS, MEYR. (PLATE XIII, FIG. 2.)

Eucosma leucaspis, Meyr., Gardiner's Fauna Geogr. Maldives, I, 126 (1902)(1), B. J., XVII, 136 (1906)(2).

Argyroploce leucaspis, Meyr., B. J., XIX, 592(3), Tr. Linn. Soc. (2) XIV, 270 (1911) (4); Proc. Second Entl. Meeting, p. 229 (1917)(5).

Recorded from Ceylon(2), the Maldive Islands(1), and the Seychelles(4). In India it is widely distributed and we have it from Pusa, Nagpur, the Khasi Hills and Kandy.

A. leucaspis has been reared at Pusa in August 1917, from larvæ found rolling tender *litchi* (*Nephelium litchi*) leaves. A single leaf may be rolled longitudinally or two or three leaves may be rolled up together. From larvæ collected on 14th August 1917, moths emerged from 23rd August to 8th September 1917.

The full-grown larva is about 14 mm. long and 1·5 mm. broad, elongated, tapering slightly towards either extremity, skin soft, uniform green with a yellowish tinge, the colour changing to coppery grey prior to pupation; head yellow; primary hairs thin and short; prolegs equally developed, short. The larvæ are very sensitive and jump vigorously when disturbed, usually taking several springs before coming to rest. (Pusa Insectary Cage-slip 1652.)

ARGYROPLOCE PARAGRAMMA, MEYR. (PLATE XIV, FIG. 1.)

Argyroploce paragramma, Meyr., B. J., XIX, 598 (1909)(1); Fletcher, Pusa Ann. Rept. 1917-18, p. 102, t.17 f.1. (1918)(2).

Bred at Pusa in September, from stem of bamboo(1).

This species was bred in September 1905, at Pusa from larvæ found boring into young bamboos. On 28th July 1917, larvæ were again found at Pusa boring into bamboos, the younger larvæ being usually found under and at the base of the loose leaf-like top portions of the sheaths, and larger larvæ boring the tender stem under cover of the sheaths. In August 1917, the larvæ were noted as being very common at Pusa; not only were they found in young shoots but also in older shoots ten to twelve feet high, boring in at the eyes under the sheaths, their presence being indicated by the frass. On 1st September 1917, the larvæ were again noted as being quite common. In cases where several larvæ bore into a young shoot, this is killed off; but in older shoots the larvæ do comparatively little damage. This species, however, must be considered as a distinct pest of bamboo.

The full-grown larva is about 15 to 17 mm. long, cylindrical, tapering slightly towards either extremity, brown; head flattened, red-brown; prothoracic

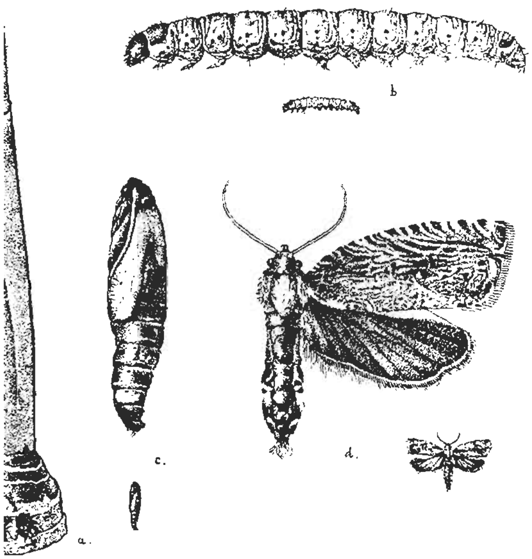


Fig. 1. *Argyroploce paragramma*: *a*. Bamboo shoot with outer sheathing leaves removed showing bore-hole of larva: *b*. larva:

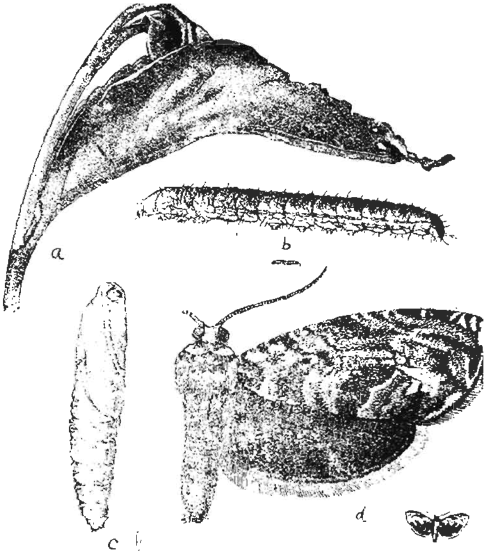


Fig. 2. *Laspeyresia leucostoma*: *a*. Tea-leaf rolled by larva: *b*. larva: *c*. pupa: *d*. moth: natural sizes and magnified.

shield large, dark-brown, almost black; prolegs equally developed; the tubercles on body segments forming distinct rounded warts.

In confinement pupation took place in a thin silken cocoon lining folds of paper or cloth or between fragments of bamboo-sheaths; under natural conditions the cocoon is probably placed beneath the leaf-sheaths. The brown pupa protrudes to some extent through one end of the cocoon on emergence of the moth. (Pusa Insectary Cage-slips, 132, 1631.)

We have this from Pusa, Chapra and Gauhati. It is probably widely distributed in the Plains.

ARGYROPLOCE POETICA, MEYR.

Eucosma mosaica (*nec* Low.), Meyr., B. J., XVIII, 138-139 (1907)(1).

Argyroploce poetica, Meyr., B. J., XIX, 437 (1909)(2), Proc. Linn. Soc. N.S.W., XXXVI, 282-283 (1911) [Redescr.] (3).

This species was originally described from Maskeliya ((Ceylon)(1) and the Palni Hills, and has since been recorded from North Australia(3). It has been reared at Pusa in October 1917, from larvæ found rolling leaves of *Polyalthia longifolia*.

ARGYROPLOCE RHYNCHIAS, MEYR.

Platypeplus rhynchias, Meyr., B. J., XVI, 586 (1905)(1).

Argyroploce rhynchias, Meyr., Exot. Micr., I, 275 (1914)(2).

Originally described(1) from Ceylon, this species has been bred from pods of *Canavalia* in Mauritius(2).

ARGYROPLOCE SEMICULTA, MEYR.

Argyroploce semiculta, Meyr., B. J., XIX, 604 (1909)(1).

Argyroploce semiculta, Meyr., Exot. Micr., II, 20 (October 1916)(2).

"Larva feeding among very tightly-spun terminal leaves of *Alseodaphne semecarpifolia* (Lauraceæ); pupa beneath folded edge of same leaf *(Maxwell)(2)*."

Originally described from Hakgala, in Ceylon, and the Khasi Hills(1). Maxwell's record of the larva was presumably made in N. Kanara.

ARGYROPLOCE TONSORIA, MEYR.

Argyroploce tonsoria, Meyr., B. J., XIX, 592-593 (1909)(1).

Bred from larva in fruit of *Barringtonia racemosa* from Bentota, in Ceylon(1).

LASPEYRESIA KŒNIGANA, FB.

Pyralis kœnigana, Fabr., Ent. Syst. III, ii, 279 (1794)(1).
Hemerosia aurantiana, Pryer, Cist. Ent. II, 235. t.4 f.12 (2).
Laspeyresia aurantiana, Meyr., Pr. Linn. Soc. N.S.W., XXXVI, 292-293, (1911)(3).
Laspeyresia kœnigana, Fletcher, S. Ind. Ins., pp. 450-451, f. 328 (1914)(4).

A very widely-distributed species in the Plains of India and Burma. The Pusa collection contains specimens from Coimbatore, Siruguppa (Bellary), Surat, Purulia, Chapra, Pusa, Minbu and Tatkon (Burma).

At Surat it is said to have bred from larvæ on *mogra* (*Jasminum sambac*) and at Coimbatore it has been reared from larvæ feeding on leaves of *nim* (*Melia azadirachta*). The larvæ have also been found on *nim* at Serampur by Mrs. Drake.

LASPEYRESIA HEMIDOXA, MEYR.

Laspeyresia hemidoxa, Meyr., B. J., XVIII, 145 (1907)(1).

This lovely little moth was described from the Khasi Hills(1).

We have it from the Khasi Hills (about 1,500 feet) and Taliparamba (Malabar). At Taliparamba a single specimen was reared on 2nd August 1909, from a larva boring in shoots of pepper vine.

LASPEYRESIA LEUCOSTOMA, MEYR. (PLATE XIV, FIG. 2.)

Laspeyresia leucostoma, Meyr., B. J., XXI, 876 (1912)(1), Exot. Micr., II, 23 (1916) (2); Proc. Second Entl. Meeting, p. 20 (1917)(3).

Described originally from Ceylon (Maskeliya), the Palni and Khasi Hills(1).

"Larva feeding in rolled leaves of *Thea sinensis* (Fletcher)"(2).

This species occurs also in the Nilgiris, having been reared at Coimbatore from larvæ found rolling tea-leaves on Waterfall Estate in May 1915, and in the Kanan Devan Hills (Travancore) whence we received in April 1917, by kind courtesy of Mr. A. G. Murray, of Munaar Estate, specimens of larvæ from which a moth was reared at Pusa on 14th May 1917. I have also seen a specimen from Assam.

This caterpillar is commonly called "Tea Flush Worm" in Southern India and its habits are apparently much the same as those of *Homona coffearia*. No detailed description was made but the accompanying figures show an attacked tea-shoot, larva, pupa and moth of this species. (Pusa Insectary Cage-slip 1556.)

LASPEYRESIA CAPPARIDANA, Z.

Grapholitha capparidana, Zeller, Isis, 1847, 734-735([1]); Rag., Ann. S.E. Fr. 1894, 218([2]).

Originally described from Sicily([1]). this species has been found in India at Pusa and is doubtless widely distributed. Its specific name records the fact that it was originally found associated with a species of *Capparis*.

The larva has been found at Pusa boring stems of *bagnahi* (*Capparis horrida*), tunnelling right through the stem and filling the tunnels with pellets of frass. Small holes are found here and there on the exterior of the affected stem, their openings being covered with frass bound together with silk.

The larva is about 8 mm. long, cylindrical, yellow, with equally developed prolegs ; head, prothoracic and anal shields yellow-brown.

The larva pupates inside the stem in a thin white silken cocoon formed near a hole and with the head of the pupa turned towards the hole. At emergence of the moth, the pupa protrudes from the cocoon to some extent and the empty pupa-cases may be seen protruding from the attacked stems.

The pupa is about 5 mm. long, brown ; abdominal segments with minute hooks arranged across dorsum ; anal segment rather truncate with two small upturned hooks dorsally and eight slender cremastral hooks arranged circularly.

From stems collected on 10th February 1910, moths emerged between 14th February and 20th March 1910. (Pusa Insectary Cage-slip 819.)

LASPEYRESIA MAMERTINA, MEYR. MS.

This species has been reared at Pusa from larvæ found on 21st January 1917, fastening together superimposed leaves of *Loranthus* and eating the tissues of the leaves whilst remaining hidden. The moths emerged between 1st and 7th March. (Pusa Insectary Cage-slip 1519.)

LASPEYRESIA PTYCHORA, MEYR.

Laspeyresia ptychora, Meyrick, B. J., XVIII, 147 (1907)([1]), Proc. Linn. Soc. N.S.W., XXXVI, 288 (1911) [Redescr.]([2]), Exot. Micr., I, 565 (1916)([3]).

Bred from larvæ feeding in pods of *Vigna sinensis*, "cowpea," at Salisbury, Rhodesia ; also from Barberton, Transvaal. Doubtless spread artificially with its foodplant([3]).

Originally described from Madulsima and North Coorg([1]), this species is also known from Queensland([2]) and we have it from Coimbatore, where it was bred on 21st February 1915, from a larva on pods of *Cajanus indicus*, and from Cherrapunji.

LASPEYRESIA PYCNOCHRA, MEYR. MS.

Bred at Coimbatore on 20th March 1916, from a larva found in pods of *agathi* (*Sesbania grandiflora*).

LASPEYRESIA MALESANA, MEYR. MS.

Bred at Coimbatore on 20th March 1916, from a larva in *Parkinsonia* pods. Also reared at Coimbatore from *Cassia corymbosa* pods.

LASPEYRESIA DÆDALOTA, MEYR.

Laspeyresia dædalota, Meyr., Exot. Micr., II, 23 (October 1916)(1).

Bred at Pusa "in July from flowers of *Cassia fistula* (Leguminosæ)(1)." Larvæ were found on 27th June 1915, damaging unopened flowers of *Cassia fistula* and moths emerged between 8th and 15th July. No description of the early stages was made. (Tahl Ram's Cage-slip 22.)

LASPEYRESIA JACULATRIX, MEYR.

Laspeyresia jaculatrix, Meyr., Rec. Ind. Mus. V, 219(1); Lefroy, Ind. Ins. Life, pp. 530-531 (1909)(2).

Described from Calcutta and Pusa, where the larvæ were found beneath bark of *Dalbergia sissu*(1). The Pusa collection contains specimens from Pusa, Palamau and the Shevaroys.

"The larvæ are found in the bark of the sissu tree (*Dalbergia sissu*) and occur there abundantly. Pupation takes place in a fine silken cocoon. Apparently these larvæ are the hosts of a small Bombylid fly, which has been reared from a batch of larvæ in sissu bark; the food of the larva is not known but it probably is the bark of the tree.

"The caterpillars spend the winter in the bark of the tree and have a curious habit of coming out at night during a few days in March, crawling about on the bark and, soon after daylight, retreating into the bark again; immense numbers of them can be seen in the early morning on these days and the phenomenon is apparently so regular that the crows know it, and we have in four successive years (1906-1909) seen crows collected round trees on which these caterpillars were walking and feeding on them. Apparently this proceeding is preliminary to pupating and is probably the search for a good sheltered nook in which pupation can be accomplished in such a way as to enable the moth to emerge. The moths emerge at various dates during May and June and there are probably two broods, before the hibernation brood referred to above. The moths are found flying about gregariously and this species is quite commonly captured where the sissu grows abundantly(2)."

The above statement that the larval food is probably the bark of the tree is not correct; the larva feeds on the leaves and apparently only hides under the bark in the intervals of feeding. Pupation may take place under the bark or between two rolled or superimposed leaves, the cocoon lining the leaves being much larger than seems requisite to contain the enclosed pupa. One individual which pupated amongst leaves on 23rd February 1914, emerged as a moth on 7th March 1914; but the period of emergence is a prolonged one and specimens have been bred out between 30th April and 2nd July from larvæ collected at the end of March and between 29th May and 20th July from larvæ collected in the latter half of May, so that it appears that the broods are irregular and overlap one another.

As noted above the larvæ are attacked by a Bombylid fly whose maggots consume the entire contents of their host after the latter has pupated and pupate inside its empty pupa-case. These Bombylid flies have been bred out between 15th and 24th April 1916.

The larvæ are also attacked by a Hymenopterous parasite which was reared between 24th March and 2nd April 1914. The parasitic grubs emerged from the body of their larval host and formed cocoons within rolled leaves but apart from the dead body of the host.

The full-grown larva is about 10 mm. long, subcylindrical, pale yellow; head brown, flattened, small; legs and prolegs normal, unicolorous with body.

The pupa is about 5 mm. long, cylindrical, slightly tapering towards either extremity, anal extremity blunted, reddish brown; abdominal segments dorsally with transverse rows of minute spines; anal segment with four cremastral hooks. (Pusa Insectary Cage-slips 336, 1030, 1056, 1391; C.S. Misra's Cage-slip 32; A. Mujtaba's Cage-slip 1.)

LASPEYRESIA TRICENTRA, MEYR.

Laspeyresia tricentra, Meyr., B. J., XVII, 734 (1907)(1), P. Z. S., 1908, 721-722(2); Lefroy, I.I.L., p. 531, t.54 (1909)(3); Fletcher, S. Ind. Ins., p.451, t.40 (1914)(4); Proc. Second Entl. Meeting, p. 70 (1917)(5).

Dicrocrampha subsequana, Swinh., Cat. Moths India, p. 699 (1889), [*nec* Haw.](6).

Larva in stems of *Crotalaria*(1). Widely distributed throughout India and Ceylon. Also recorded from Transvaal(2).

"*L. tricentra*, Meyr., is described from the Deccan, the larva tunnelling in the shoots of Sann-hemp (*Crotalaria juncea*)(3)."

The Pusa collection contains specimens from Surat, Bassein Fort (Bombay) and Yercaud, and from Coimbatore (reared from cowpea pods).

This species has been confused with *L. pseudonectis* and it is doubtful whether the earlier Pusa records, ascribed to *L. tricentra*, are really referable to this species.

LASPEYRESIA PSEUDONECTIS, MEYR. (PLATE XV.)

Laspeyresia pseudonectis, Meyr., B. J., XVIII, 146-147 (1907)(1); Lefroy, Ind. Ins. Life, p. 531, t.54 [?] (1909)(2); Proc. Second Entl. Meeting, pp. 69-70 (1917)(3).

Larva tunnels stems of *Crotalaria juncea* at Surat in October(1).

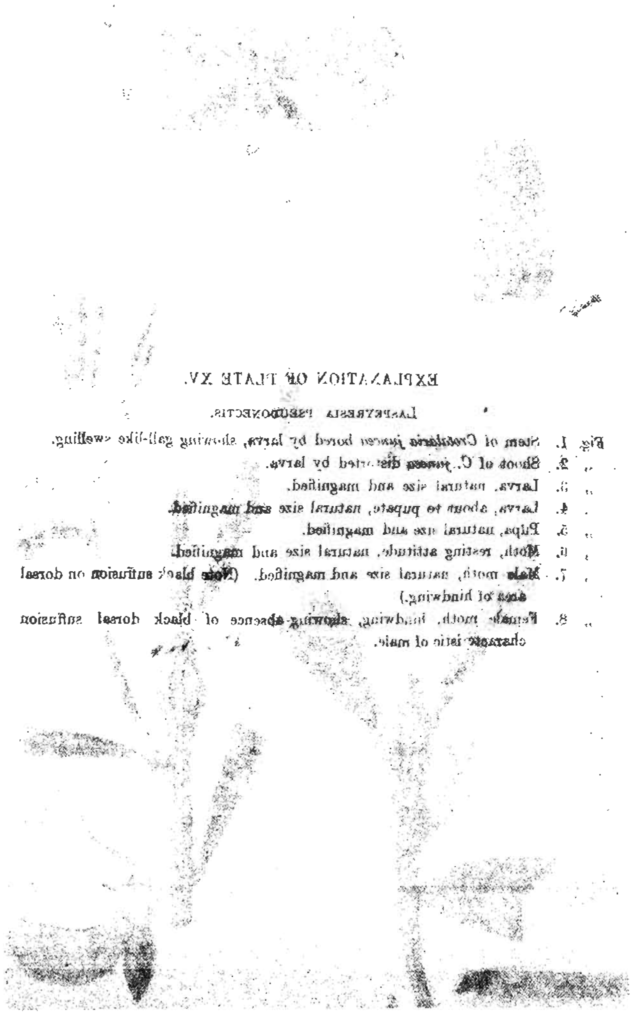
"*L. pseudonectis*, Meyr., has the same habit [as *L. tricentra*, Meyr.] and was reared from Sann-hemp at Surat, and in Bihar. It is a common pest to this crop, and with the proceeding [preceding] is probably widespread in India. [Plate LIV](2)." It may be added that the Plate LIV here referred to is a very poor one and it is doubtful whether it really refers to *L. pseudonectis* or *L. tricentra*.

"*Laspeyresia pseudonectis* attacks Sann-hemp whilst the crop is still young, about five or six inches high. At that stage of growth the caterpillar attacks the top-shoot which is formed into a characteristic gall. The attack does not stop altogether the growth of the plant, which grows in length. In later stages of growth of the plant, the attack takes place at the axils of leaves, where also a swelling is formed. In this latter case, the fibre is affected. There may be more than one gall in the same plant. The caterpillar feeds inside the gall and pupates there; whilst young it is green but becomes a bright red before pupation. The caterpillar has been found to affect the capsules also, boring the seeds, but this is unusual and this habit has only been observed hitherto during the winter months. The insect hibernates as a caterpillar from November to February and then aestivates from March to June; it may be in the stem if the plants remain in the field or, if the pods are collected, the caterpillars form cocoons amongst the debris and remain there.

"As regards control, in the case of young plants the removal and destruction of the galled topshoots is necessary and this should reduce further damage(3)."

L. pseudonectis occurred in destructive numbers on Sann-hemp (*Crotalaria juncea*) at Sabour in November 1909, and has also been reported as damaging this crop in the Central Provinces and at Surat. The Pusa collection contains examples from Pusa, Coimbatore, Samalkote, Bassein Fort (Bombay) and Peshawar.

At Samalkote it was reared on larvæ on Sann-hemp and at Coimbatore from larvæ on green gram (*Phaseolus mungo*) and on horse gram (*Dolichos biflorus*).



EXPLANATION OF PLATE XV.

LASPEYRESIA PSEUDONECTIS.

Fig. 1. Stem of *Crotalaria juncea* bored by larva, showing gall-like swelling.

" 2. Shoot of *C. juncea* distorted by larva.

" 3. Larva, natural size and magnified.

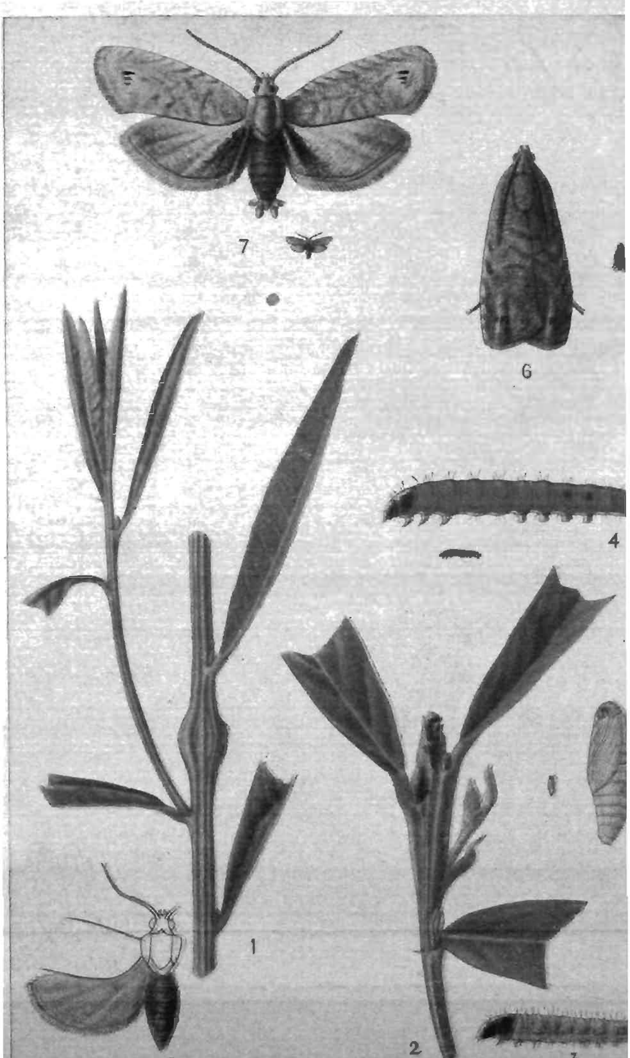
" 4. Larva, about to pupate, natural size and magnified.

" 5. Pupa, natural size and magnified.

" 6. Moth, resting attitude, natural size and magnified.

" 7. Male moth, natural size and magnified. (Note black suffusion on dorsal area of hindwing.)

" 8. Female moth, hindwing, showing absence of black dorsal suffusion characte istic of male.


7
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The full-grown larva is about 12 mm. long, cylindrical, tapering slightly towards either extremity, segments distinct, uniform orange yellow (turning to brilliant red before pupation); head shiny black; prothoracic shield shiny black, divided medially; prolegs equally developed. (Pusa Insectary Cage-slips 397, 1194, 1422, 1422a.)

LASPEYRESIA TORODELTA, MEYR.

Laspeyresia torodetta [misprint for *torodelta*], Meyr., B. J., XXII, 772 (1914)(1); Fletcher, S. Ind. Ins., p. 451, f.329 (1914)(2); Proc. Second Entl. Meeting, p. 56 (1917)(3).

Larva upwards of 10 mm. long, slender, with short hairs scattered over the body, pale green with a reddish head. It bores into the growing tips of *Dolichos lablab*, devouring the tissues of the stem so that this droops and dies. Pupation in larval burrow. Pupal period about 10 days(2).

Recorded from Coimbatore and Malabar in December and January(1, 2).

This species is only known hitherto from Southern India.

LASPEYRESIA POMONELLA, LINN.

Tinea pomonella, Linn., Syst. Nat. ed. X, I, 538 (1758)(1).

Carpocapsa pomonella, Spuler, Schmett. Eur. II, 289, t.86 f.54(2) [*et auct. num.*]

Cydia pomonella, Wlsm., A.M.N.H. (7), VI, 435 (1900)(3), P.Z.S. 1907, 1006(4).

Laspeyresia pomonella, Meyr., P. Linn. Soc. N.S.W., XXXVI, 287 (1911)(5); Proc. Second Entl. Meeting, p. 249 (1917)(6).

The notorious "Codling Moth," which is a most important pest of apples in Europe, America, Australia, and New Zealand, has been recorded from Kashmir (Dras Ladak, 7,000 feet)(3), but does not appear to be known in any of the apple-growing tracts in India. An unidentified Tortricid larva, found boring into apple fruits in Kumaon in August 1918, is certainly not this species. [See page 197, *postea*.]

LASPEYRESIA PULVERULA, MEYR.

Laspeyresia pulverula, Meyr., B. J., XXI, 876 (1912)(1).

Originally described from the Khasi Hills(1), this species has been bred at Dehra Dun by Mr. C. Beeson (1), from *sal* (*Shorea robusta*) collected at Jhafra on 27th January 1916, the moth emerging on 14th March (2); from *sal* log attacked by *Sphærotrypes* and collected in the Jara Range, Pilibhit Division, before 10th April 1916, the moth emerging on 21st May; and (3) from *sal* log attacked by *Sphærotrypes*, collected at Jabbokhet on 9th September 1916, the one moth emerging on 18th October 1916.

PAMMENE ISOCAMPTA, MEYR.

Pammene isocampta, Meyr., Exot. Micr., I, 196-197 (1914) (1).

Described from Peradeniya, where it was found "associated with *Lecanium* sp(1)."

PAMMENE THERISTIS, MEYR.

Pammene theristis, Meyr., B. J., XXI, 874 (1912)(1); V. S. Iyer, Rept. Bd. Sci. Adv. India, 1909-10, p. 151(2).

Described from Maskeliya and Kumaon(1). Bred from seedlings of *Shorea robusta*(1). Larva attacking roots of one-year old *sal*-seedlings; also in *sal* tfruit; apparently two generations in the year(2).

CHLIDANOTIDÆ.

The Chlidanotidæ form a small group, with about half-a-dozen described Indian species, of whose life-histories nothing whatever is known at present. The Indian genera contained in this Family are *Archimaga*, *Chlidanota*, *Eletracma*, *Matrernis* and *Trymalitis*. "*Ichthyura*" *argentea*, Butl. (Ill. Het. VI, 24, t.102 f.12; Hmpsn., Moths Ind., I, 176), described from Darjiling, also belongs to an undescribed genus of this group.

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

LIFE-HISTORIES OF INDIAN INSECTS
MICROLEPIDOPTERA

III. GELECHIADÆ

BY

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PLATE XVI.

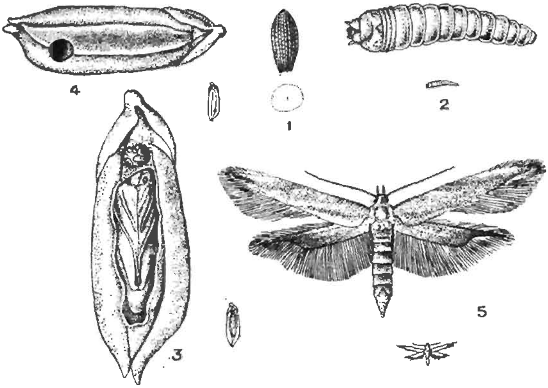

Fig. 1. *Sitotroga cerealella*:—1, Egg ; 2, larva ; 3, pupa inside grain ; 4 attacked grain after emergence of moth ; 5, moth : all natural sizes and magnified.

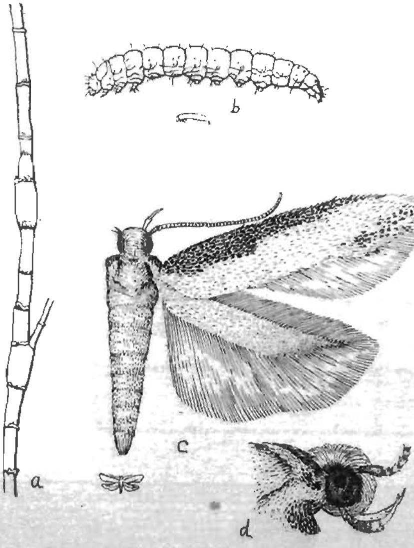

Fig. 2. *Aristotelia ingravata*:—*a*, Tamarix twig bored by larva, showing two galls ; *b*, larva (x 7) ; *c*, moth (x 13) ; *d*, head of moth, from side, more highly magnified.

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NILGIRI

[Received for publication on 27th June 1919.]

SITOTROGA CEREALELLA, OLIV. (PLATE XVI, FIG. 1.)

Alucita cerealella, Oliv., Enc. Meth., IV (Ins. I.), 121 (1789)(1).
Sitotroga cerealella, Wlsm., P. Z. S., 1907, 928 (1908) [synonymy](2); Fletcher, S. Ind. Ins., p. 456, f. 331 (1914)(3), Entl. Note 79 (1916)(4).

A cosmopolitan species, the larva found on grain of all kinds; known from N. America, S. Africa, Australia, Europe, India, Ceylon and Japan. It occurs commonly throughout India, Burma and Ceylon and we have it from a number of localities ranging from Peshawar to Coimbatore and Mandalay. North Indian specimens are much larger than those from South India but otherwise there seems to be no difference.

The larva feeds on stored grain (rice, maize, etc.), and is always a minor and sporadically a major pest. Mr. Beeson has also reared this species from bamboo seeds. The whole larval life is passed inside the grain, a single grain sufficing for each larva. Breeding goes on throughout the year except when the temperature is low, the life-cycle taking about four weeks as a rule, but it may last for only three weeks or it may extend up to six weeks, the egg stage lasting for about six days and the pupal for about eight days.

In the case of paddy grain, the egg is always placed inside the scale enveloping one end of the unhusked grain, and from one to five eggs may be packed into this space. Rarely eggs are laid exposed on the grain. Sometimes also many eggs are laid in a cluster hidden in the midst of the grains. Eggs may be laid in the daytime as well as at night.

The egg is about 0·5 mm. long and 0·26 mm. broad, cylindrical, rather stout, translucent white with longitudinal ridges and furrows; the micropylar area, at one end, is flattened and contains a slight circular concavity; the other end of the egg is rounded or slightly tapering. Within a day of deposition the colour of the egg changes to yellowish and it continues to deepen until it is almost brown. The larva emerges by eating through the concave portion of the micropylar area; some larvæ eat a little more of the egg-shell, but only so much of the shell is eaten as is necessary for the emergence of the larva. The empty egg-shell is white. As many as 117 eggs were laid by one female moth between 25th July and 31st July, the moth dying on 3rd August.

The newly-hatched larva is less than 1 mm. long, cylindrical, pinkish-yellow; head brown; five pairs of equally developed prolegs. It seldom bores into the grain on which the egg was deposited but wanders about and selects a grain into which it begins to bore by making a hole in the cavity left by the breaking away of the stalk. After boring a little way into one grain it may leave it and wander about again in search of another. When once it has really entered into a grain, however, it does not leave it again but passes the rest of its larval life in that grain. There is never more than one larva in one grain, at least in the case of rice. Before it has finally settled down, the larva is very quick in its movements, but when grown larger it can hardly walk and seems to be helpless if removed from the grain, nor can it bore into another grain. The larva makes its way directly into the starchy part of the grain and the germ is left untouched. By the time that the larva is full-grown the whole of the starchy portion (of a rice grain) has been consumed.

The full-grown larva is about 6 mm. long and about 1 mm. broad, body very soft with the segments fairly distinct, pure white, with scattered minute white hairs; head smaller than prothorax, into which it is at times retracted pale yellow, mouthparts brown; prothoracic shield large, pale yellow; spiracles round, rimmed with yellow; five pairs of reduced prolegs.

Pupation takes place inside the grain in which the larva has fed. The pellets of frass are pushed to one side and there is formed a white silken cocoon lining almost the whole length of the cavity formed by the larva. The end of the cocoon next the capital extremity of the pupa is left open and the hard covering of the grain at this part is eaten just so much as to leave a thin membranous cover for the open mouth of the cocoon. This cover is broken through by the moth on its emergence.

The pupa is about 5 mm. long and about 1·25 mm. broad, yellow-brown Thin hairs are present on the posterior abdominal segments and cremastral hairs on the anal segment. The last larval skin is pushed to the posterior end

of the cocoon and the cremastral hairs are not entangled in the fibres of the cocoon, although the pupa-case is left inside the cocoon on emergence of the moth.

Eggs laid on 21st hatched on 27th July 1909, and moths emerged from these larvæ between 18th August and 4th September. During cold weather the emergence of the moths is suspended until warmer conditions return. In the case of a quantity of affected paddy grains kept at Pusa, the number of moths emerging became less and less as winter set in until the last moth emerged on 22nd December; no more appeared until 16th January, when one moth emerged, followed by one moth on 10th February, and three on 14th February; after that, the weather became warmer and many moths began to emerge. (Pusa Insectary Cage-slip 771.)

TELPHUSA MELANOZONA, MEYR.

Telphusa melanozona, Meyr., Exot. Micr., I, 65 (1913)(1).

Reared at Pusa in August from larvæ mining leaves of *Euphorbia eriifolia* (1).

Larvæ were collected at Pusa on 15th August 1910, mining leaves of *sij* (*Euphorbia nivulia*). The larva mines the leaf, only a portion of which is sufficient to supply food for its whole larval life. A portion near the apex or about the middle of the leaf is attacked, the larva mining from the margin inwards, the attacked portion withering and turning brown.

The larva is about 10 mm. long and about 1 mm. broad, cylindrical, yellow, soft-bodied, with short scattered hairs; head rather darker.

Pupation takes place usually inside the mine, the larva first preparing for the exit of the moth by making a small hole whose opening is closed by a thin membrane, and then lining the pupal chamber with a very thin layer of silk. The pupa is yellow-brown, the anal segment with a few small cremastral hairs which retain the pupa-case inside the cocoon on emergence of the moth. Occasionally the larva pupates outside of the mine on a leaf, and in such cases it forms a cocoon composed of silk and chewed-up pieces from the epidermis of the leaf. The pupal period is about six days in August. (Pusa Insectary Cage-slip 855.)

ARISTOTELIA INGRAVATA, MEYR. (PLATE XVI, FIG. 2.)

Aristotelia ingravata, Meyr., Exot. Micr., II, 118–119 (1918)(1).

Bred at Pusa from larva forming galls in twigs of *Tamarix gallica*. Also recorded from Peshawar.

The larva bores into a *Tamarix* stem, which swells up a little at the part bored, forming a sort of a gall inside which the larva is found. The larva

does not bore up and down inside the stem but lives in the gall, several of which may be found on the same stem at quite short distances apart (Plate XVI, figure 2*a*).

The larva is about 8 mm. long, cylindrical, slightly tapering towards either extremity, brownish-yellow, prothorax and anal segment tinged with pinkish; head black, shiny; prothoracic shield large, black, shiny; last two abdominal segments with black plates; five pairs of short prolegs.

Pupation takes place inside the gall, through one end of which the larva gnaws a round hole for emergence of the moth, this hole being stopped with a thin layer of silk, which is burst by the moth. The larva may pass the summer in a resting condition inside the gall. From larvæ collected on 15th February 1915, one moth emerged on 23rd April and another moth on 22nd October whilst larvæ were still living in the galls on 29th September 1915. Moths have also been reared out in May. The larvæ are extensively parasitized. (Pusa Insectary Cage-slip 1202.)

IDIOPHANTIS CHIRIDOTA, MEYR.

Idiophantis chiridota, Meyr., Exot. Micr., I, 201 (1914)(1).

Reared at Peradeniya in May from galls produced by a Psyllid on *Eugenia*(1).

ISTRIANIS CRAUROPA, MEYR.

Istrianis crauropa, Meyr., Exot. Micr., II, 130 (1918)(1).

"Bred at Dharwar, N. Kanara, in June from a larva feeding externally on lower surface of leaf of *Butea frondosa* (Leguminosæ) in May (*Maxwell*); pupa in spindle-shaped cocoon on leaf(1)."

EPHYSTERIS CHERSÆA, MEYR.

Ephysteris chersæa, Meyr., P. Z. S., 1908, 725(1), Exot. Micr., II, 131 (1918)(2).

Epithectis oschophora, Meyr., Rec. Ind. Mus., V, 219-220(3); Fletcher, Entl. Note 80 (1916)(4).

First described from the Transvaal(1) and afterwards from Maskeliya, Diyatalawa, Calcutta and Purneah(3), this species has since been recorded from the Tenimber Islands, New Guinea(2). We have it from Purneah, Coimbatore and Abbottabad.

The larva is stated to feed in dry vegetable refuse(2). The moth was reared at Coimbatore in 1914, from *cholam* stubble(4).

EPITHECTIS STUDIOSA, MEYR.

Epithectis studiosa, Meyr., B. J., XVI, 591–592 (1905)(1).

Described from Peradeniya, where the larva was found feeding on dried plants in the herbarium(1). The Peradeniya collection also contains specimens under this name reared from rice received from Northern India.

PHTHORIMÆA HELIOPA, LOWER.

Gelechia heliopa, Lower, P. Linn. Soc. N. S. W., 1900, 417(1).

Gnorimoschema heliopa, Meyr., P. Linn. Soc. N. S. W., 1904, 320–321(2), B. J., XVI, 592 (1905)(3); Lefroy, Ind. Ins. Pests, p. 156(4), Ent. Mem. Agr. Dept. Ind., I, 224(5), Ind. Ins. Life, pp. 534-535(6), Agr. Jl. Ind., III, tab.(7); Fletcher, S. Ind. Ins., pp. 454-455, t. 43 (1914)(8).

Phthorimæa heliopa, Fletcher, Entl. Note 81 (1916)(9), Proc. Second Entl. Meeting, p. 272 (1917)(10).

Originally described from Australia(1) this species is widely distributed in India and Ceylon, and probably occurs in Java also. It occurs throughout the Plains of India, Burma and Ceylon, but we have no records from North-Western India. Our records are from Hanguranketa (Ceylon), Coimbatore, Shevaroy Hills, Hagari, Penukonda (Anantapur District), Tharsa, Gujarat, Nadiad, Anand District, Pusa, Rangpur and Zigonkwin (Burma). In most districts this seems to be a minor pest of tobacco, the larva boring into the stem and causing a characteristic gall-like swelling, but it is sporadically serious and in Western India it is a major pest of tobacco.

The egg is elongate-oval, about 0·5 mm. long, greenish at first, changing later to orange-yellow. The eggs are laid at night indiscriminately anywhere on the plant but especially on the lower surfaces of the leaves. In confinement one female laid 58 eggs during one night, dying next day. The egg hatches after about 19 days in December or 11 days in March.

The newly-hatched larva is about 1 mm. long, cylindrical, translucent yellowish-white; head large, black; prothoracic shield small, black; a few hairs scattered over segments; five pairs of prolegs. It emerges from the egg by gnawing a hole at one end but the egg-shell is more or less burst open longitudinally. The empty egg-shell is not eaten by the young larva. As it grows the yellow tinge is gradually lost and the full-grown larva is about 10 mm. long, cylindrical, tapering slightly posteriorly, segments fairly distinct, translucent whitish or greyish; head smaller than prothorax, dark-brown; prothoracic shield large, black, divided medially; fifth abdominal segment with a brownish patch; spiracles round, rimmed with black; five pairs of prolegs.

The young larva bores into the tissue of a tobacco leaf, usually near the place where it has emerged from the egg, in cases where the egg was laid on a leaf, and mines into the leaf. If the egg was laid on a stem, the young larva bores directly into the stem. The mine in the leaf is not large as the larva, as soon as it comes across a vein, bores into that until it reaches the midrib of the leaf, leaving a trail of black pellets of excrement behind it. The larva may take about a week to reach the midrib, the time depending on the distance it has to travel. In the case of young plants with hardly any stem the larva may remain in the midrib and pupate there; but, when there is a stem, the larva bores into that through the midrib. In either case, whether in midrib or stem, the feeding of the larva produces a gall-like swelling which is a characteristic sign of attack. This swelling is not immediately evident but appears two or three weeks (in the cold weather) after the larva has reached the midrib. More than one larva may be present in one stem and thus slitting of the stems, as sometimes practised, does not ensure removal of all the larvæ.

Pupation takes place in the larval tunnel in the stem or midrib. Prior to pupation the larva prepares a hole of exit for the moth, the mouth of the hole being covered with a thin white silken webbing. The larva next prepares a thin brownish silken cocoon lining the tunnel and pupates in this. The pupa is about 6 to 7 mm. long, cylindrical, tapering posteriorly, brown, anal segment with small grey cremastral hooks. The empty pupa-case remains inside the cocoon.

The moth is active only at night and passes the day resting motionless on the plants or any suitable object. The moths live in confinement for six to twelve days.

The following table shows the life-cycle during the winter but in the warm weather the period is much shortened :—

Eggs laid	Eggs hatched	Larvæ pupated	Moth's emergence	Duration days
6–XII	20–XII	9–II	9–III	93
6–XII	20–XII	4–III	31–III	115
8–XII	21–XII	3–II	5–III	87
10–XII	23–XII	2–III	20–III	100
18–XII	6–I	..	30–III	102
18–XII	6–I	..	2–IV	105
22–XII	10–I	..	26–III	94
22–XII	10–I	..	5–IV	104

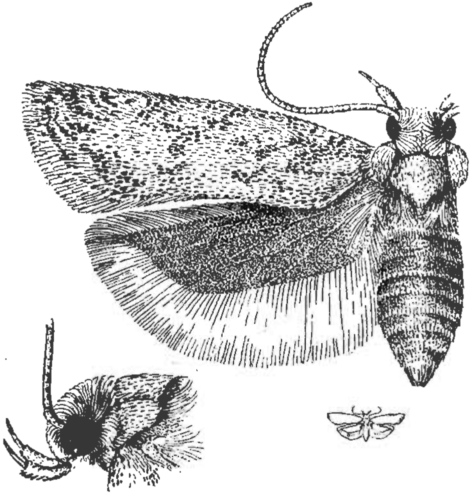


Fig. 1. *Phthorimaea blapsigona*: Moth, natural size and magnified. Below is seen a more highly magnified view of the head, as seen from the side.

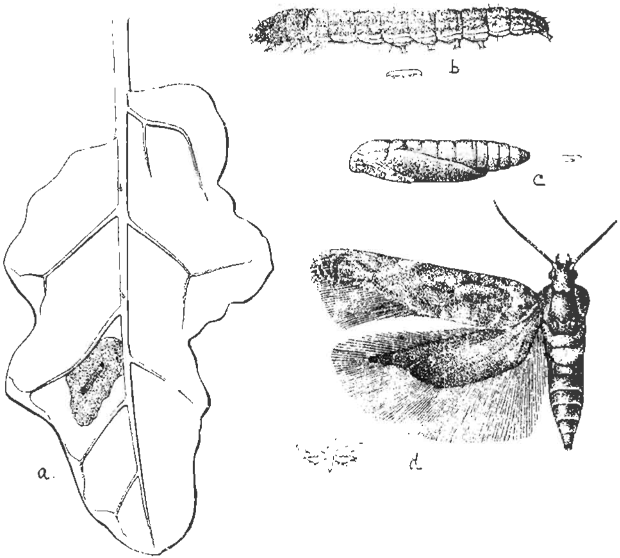
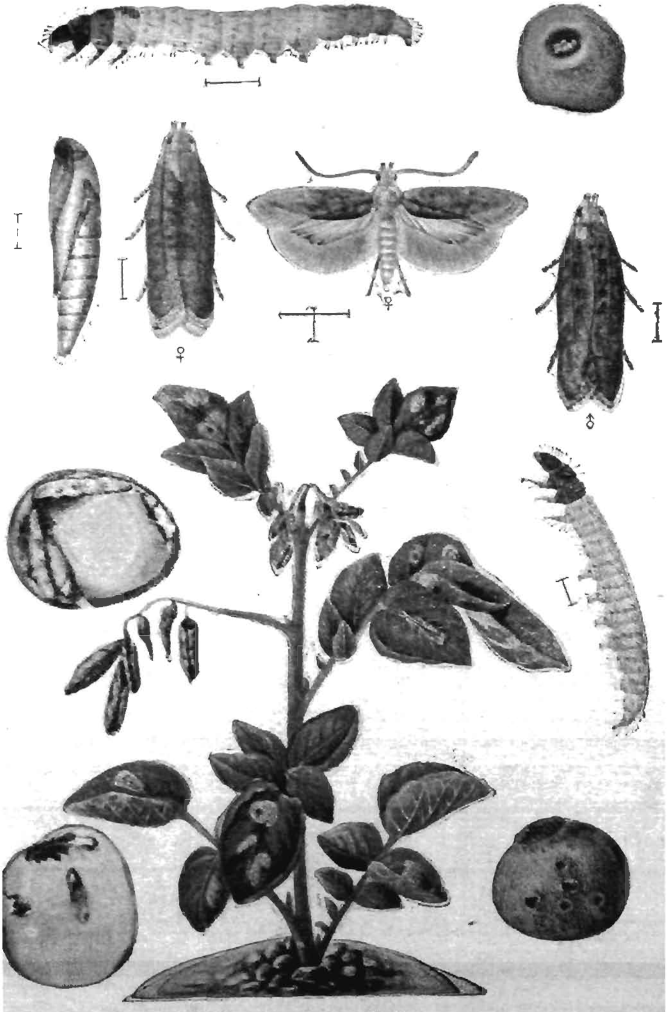


Fig. 2. *Phthorimaea ergasima*:- *a.* Brinjal leaf with larval mine; *b*, larva; c. pupa; *d*. moth; natural sizes and magnified (x 8).



PHTHORIMÆA OPERCULELLA.

EXPLANATION OF PLATE XVIII.

PHTHORIMAEA OPERCULELLA.

Fig. 1 A potato plant showing injury caused by the larvæ.

" 2. *Moth resting on plant.*

" 3. Potato tuber showing evidences of caterpillar attack in the masses of excrement at the eyes. A cocoon on the tuber.

" 4. Potato tuber cut open to show damage caused by caterpillar.

" 5. Potato tuber showing the track of the caterpillar and the pupa.

" 6. Young larva.

" 7. Imago, male.

" 8. } " female.
" 9. }

" 10. Pupa.

" 11. Adult larva.

" 12. Eggs deposited at the eye of a potato tuber, magnified

(The hair-lines show the natural sizes.)

PHTHORIMÆA BLAPSIGONA, MEYR. (PLATE XVII, FIG. 1.)

Phthorimæa blapsigona, Meyr., Exot. Micr., I, 569 (May 1916) ([1]); Proc. Second Entl. Meeting, p. 288 (1917)([2]).

Described from specimens reared at Coimbatore in July and August from larvæ feeding on buds of *brinjal* (*Solanum melongena*)([1]).

This species has been reared at Coimbatore, Saidapet and Nagpur from larvæ boring and feeding in flower-buds of brinjal. It is also reported to bore into the fruits at Nagpur, and is stated to be a decided pest in Madras and the Central Provinces. We have not been able to find this species at Pusa and have no details of its early stages.

PHTHORIMÆA OPERCULELLA, Z. (PLATE XVIII.)

Gelechia operculella, Zeller, Verh. ZB. Ges. Wien., XXIII, 262-263, t. 3, f. 17 (1873)([1]).

Phthorimæa operculella, Wlsm., P. Z. S., 1907, 942 [synonymy]([2]); Meyr., T. L. S. (2) XIV, 273 (1911) ([3]); Lefroy, Ind. Ins.Life, p. 535, t. 57 (1909)([4]), Agr. Jl. Ind., V, 19-28, t. 1 (Jan. 1910) ([5]); Fletcher, S. Ind. Ins., p. 455, t. 44 (1914)([6]); Proc. Second Entl. Meeting, pp. 286, 288 (1917)([7]).

This species, which has been carried to almost all parts of the World with potato tubers, was brought into Bombay from Italy probably about twenty years ago, and has now spread into most of the potato-growing districts of India, where it is a very important pest of the stored tubers. It has also been found at Dharwar on one occasion mining brinjal leaves (Entomological Note 77). Our records include Mirpurkhas (Sind), Poona, Dharwar, Nilgiris to 6,500 feet, Coimbatore, Chindwara, Sitamarhi, Partabgarh, Bankipur, Bettiah, Pusa and Purneah, but there is no doubt that this species is still spreading and will ultimately invade all the potato-growing districts in India.

In America and South Africa this species is well-known as a destructive miner in tobacco leaves, but it has not been noted to attack tobacco in India. It has also been noted on tomato, *Solanum torvum*, *S. verbascifolium*, *S. carolinense*, *S. nigrum*, *Physalis peruviana*, *Physalodes physalodes*, and *Datura stramonium*, but has not been recorded on these foodplants in India.

The early stages have been described by Morgan and Crumb (*U. S. A. Dept. Agric. Bull.* 59; 1914) as follows :—

" *Egg.* The egg is pale, translucent, yellowish-grey, and strongly iridescent; it is oval, 0·45 mm. long, 0·35 mm. broad at the middle, membranous, and without apparent sculpture. The side upon which it is deposited is slightly flattened.

"*Larva.* The full-grown larva is 7 to 14 mm. long. The head shield is 0·80 to 0·86 mm. broad and fuscous brown. The cervical shield is darker brownish-fuscous, with a pale mid-dorsal line, shining, the posterior margin medially straight. The anal shield is brown. The mesothorax and metathorax are deep maroon. The body varies in colour through green and grey and is overlaid dorsally with purplish as the larva nears pupation. It is slender, tapering from the mesothorax posteriorly and set closely and uniformly with minute granules each bearing a minute point, the granules of the thorax and the last abdominal segment being the larger. The tubercles and their setæ are inconspicuous, brownish ; tubercle II is slightly larger than I. . The legs are deep fuscous ; the prolegs, green.....The larva on potato is more greyish on the body...and has the mesothorax and metathorax pinkish instead of deep maroon.

"*Pupa.* The pupa is yellowish-brown, 5·5 to 7 mm. long and 1·5 to 2 mm. broad ; it is broadest through the metathorax, tapering both anteriorly and posteriorly. The head is rather distinct and slightly nodding. The abdomen, excepting the last three segments, is set with very minute spinules ; it bears at the tip mid-dorsally a short, curved, erect, pointed horn flanked by about four pairs of long hooked spinules, and ventrally a pair of blunt, rounded lobes beneath which are about four pairs of long hooked spinules. Each abdominal segment is set with a transverse row of spinules near the anterior margin."

A good deal of work has been done in India to combat the attack of this pest on stored potato tubers, and accounts will be found in the *Agricultural Journal of India* and in the *Bihar Agricultural Journal.* Storage under sand has been found successful in some districts, and in others fumigation with petrol vapour and subsequent storage in moth-proof godowns is used.

PHTHORIMÆA ERGASIMA, MEYR. (PLATE XVII, FIG. 2.)

Phthorimæa ergasima, Meyr., Exot. Micr., I, 568–569 (1916)(1), *l. c.*, II, 135 (1918)(2) ; Proc. Second Entl. Meeting, p. 288 (1917)(3).

Described from Pusa(1).

"Larva green, head and plate of 2 purplish ; mines a blotch in leaves of *Solanum melongena* (Fletcher)"(2).

At Pusa the larvæ mine brinjal leaves in January to March and in July and perhaps throughout the year, eating the tissues between the epidermal layers. The larva is able to emerge from its mine and walk about and enter a leaf again at another place. The mine is usually near the tip of a leaf. The larva is about 7 mm. long and about 1·25 mm. broad across the metathorax

whence it tapers prominently anteriorly and slightly posterjorly, rather flattened, segments distinct, yellowish with reddish dorsal and lateral stripes; head flattened, smaller than prothorax, dark brown, shiny; prothorax smaller than mesothorax, dark brown, with a shiny dark-brown medially-divided plate; mesothorax slightly smaller than metathorax, with reddish markings dorsally; metathorax entirely yellow; five pairs of small, equally developed prolegs. Pupation takes place either inside the mine or under the shelter of a leaf fastened down with silk. The pupal period is about seven days in July and eleven days in February. (Pusa Insectary Cage-slips 952, 1328 and Dwarka Prasad Singh's Cage-slip dated 18th February 1916.)

PHTHORIMÆA OCELLATELLA, BOYD.

Gelechia ocellatella, Boyd., Entom. Weekly Intell., IV, 143 (1858) (1); Stainton, Manual II, 340 (1859)(2); Meyr., Handbk., p. 593 (1895)(3).

Phthorimæa ocellatella, Meyr., Exot. Micr., II, 135 (1918)(4).

This is a European species recorded from Western and Southern Europe, Madeira, Asia Minor and, within our limits, from Galle (Ceylon)(1).

The larva is described by Stainton (2) as "pale greyish-white, with four dull reddish interrupted lines along the back; head pale yellowish-brown. On the flowers of *Beta maritima*."

In Italy this species has recently been recorded by Del Guercio as injurious to beet, feeding on the tender leaves and then tunnelling into the root. (See *Review Appl. Entom.*, Ser. A. Vol. VII, page 193; May 1919.)

STOMOPTERYX NERTERIA, MEYR.

Anacampsis nerteria, Meyr., B. J., XVII, 139 (1906)(1), Rec. Ind. Mus., V, 220 (2), Ann. Transvaal Mus., II, 11 (1909)(3); Lefroy, Ent. Mem., I, 226 (4), Ind. Ins. Life, p. 534(5).

Aproærema nerteria, Fletcher, South Ind. Ins., pp. 457–458, f. 333 (1914)(6), Proc. Second Entl. Meeting, pp. 43, 47, 92 (1917)(7).

Stomopteryx nerteria, Meyr., Exot. Micr., II, 138 (1918)(8).

Originally described from Maskeliya (Ceylon)(1), this species has since been recorded from India (2) and Pretoria (South Africa)(3). In India it is widely distributed in the Plains. Our records include moths reared at Coimbatore on *Cajanus indicus*, mining and folding the leaves; at Pusa and Nagpur on soybean, on the young leaves and shoots; on groundnut at Peradeniya, Coimbatore, Hagari, Dharwar and Fraserganj (Sundarbans); and on *Psoralea corylifolia* at Pusa and Nagpur. We also have moths from Peshawar and

Mandalay. In Madras it is an important pest of groundnut and is well-known under the name of *surul puchi*.

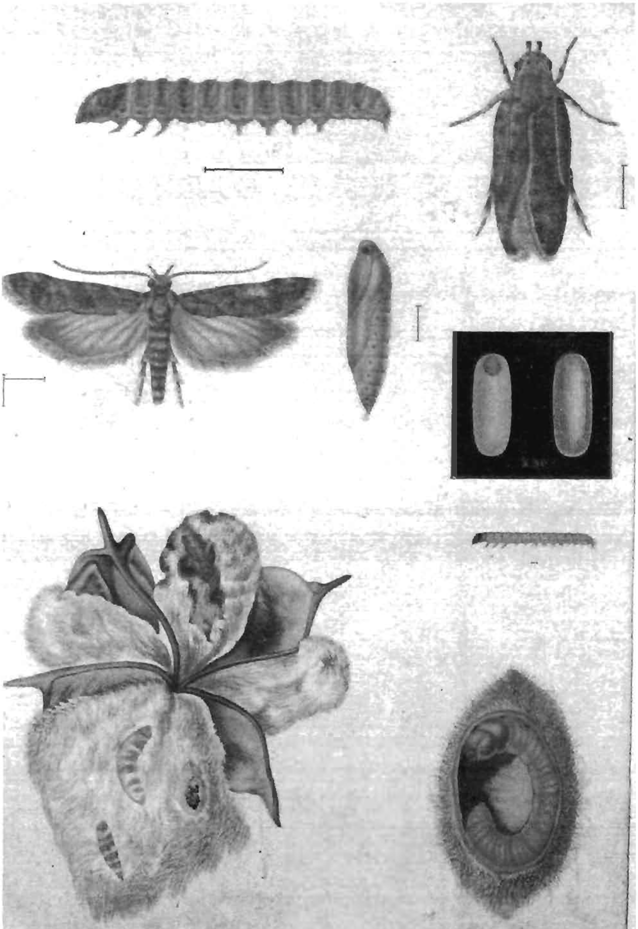
The whole life-cycle is passed on the foodplant, the egg being laid on the leaves or stems, the larva at first mining into the leaves and later on tying them together, and pupating in the larval shelter so formed.

The egg is described by Green as "pale green, irregularly elongate-oval, surface coarsely pitted in irregular longitudinal series, under the microscope remarkably similar both in form and sculpture to seed of *Arachis*." It has also been recorded by T. V. Ramakrishna Ayyar and Y. Ramachandra Rao as "about 0·35 mm. in length, longer than broad, somewhat flattened, with the proximal face resting flatly on the leaf and the distal one convex. Its external surface is ornamented with a system of ridges forming a kind of network, while its inner face, by which it is attached, is, except for a few obsolete ridges, more or less even. In colour it is creamy yellow when freshly laid; it retains this tinge to a greater or less extent until the third day, when a black dot (the head of the larva) makes its appearance, and as it approaches the time of hatching it gradually turns dark."

The egg may be laid on any part of the upper portion of the foodplant; when laid on a leaf, it is usually placed on the lower surface; as a rule the egg is laid in some slight depression on the plant.

The eggs are laid singly by night, the maximum number laid by one female being noted as 97, and hatch after three days.

The newly-hatched larva is slightly over 0·5 mm. long, dull grey, flattened anteriorly, slender posteriorly; head black; prothoracic shield light brown. It wanders about for a short time and then mines into a leaf, the mine after a day or two showing up as a whitish-brown streak; the interior of the mine is lined with a layer of silk. After mining for about eight days, the larva bites its way out of the mine and webs together two or more leaflets and lives under shelter, forming a small oval silk-lined chamber about 8 mm. long in which the larva lives and ultimately pupates. After another three or four days it is full-grown and is then about 5·5 to 6 mm. long, rather stout, faint dirty green; head, prothoracic and anal shields dark brown; each segment with tubercles from which arise pale brown setæ; legs dark brown; prolegs greenish. Male larvæ show, between the fourth and fifth abdominal segments, a pair of asymmetrically-situated dark violet testes, which are clearly visible through the skin. Pupation takes place in a closely-woven torpedo-shaped cocoon, about 9 mm. long, and usually constructed in the larval chamber to whose sides it is rather loosely attached. The pupa is about 4·5 mm. long, rather stout, yellowish or reddish brown; cephalic and thoracic regions thickly covered



PLATYEDRA GOSSYPIELLA.

with minute velvety hairs; abdominal segments with similar but longer hairs which are, however, confined to a median transverse belt on each segment; anal segment with cremastral hooks which retain the pupa-case within the cocoon on emergence of the moth. The pupal period is about four days.

The moth flies at night, hiding during the daytime in the soil, in crevices or under clods. It is strongly attracted to light at night. The moth has been found to live for sixteen days in confinement; under natural conditions its life is probably much longer.

The life-cycle is about three weeks, of which the egg stage lasts for twelve to fourteen days, and the pupal stage for four days. Under colder conditions, the cycle may be prolonged to six weeks. Under suitable conditions of temperature and presence of foodplants, this insect seems to breed throughout the year and no regular broods can be distinguished.

PLATYEDRA GOSSYPIELLA, SNDRS.

Depressaria gossypiella, Saunders, T. E. S. (1), III, 285 (1842)(1).

Gelechia gossypiella, Meyr., B. J., XVI, 592, (1905)(2); Wlsm., Faun. Hawaii, I, 731–733 (1907)(3); Lefroy, Ind. Ins. Pests, p. 93, ff. 104-106(4), Ent. Mem., I, 223, f. 69(5), Ind. Ins. Life, p. 534, f. 344 (1909)(6); Durrant, Bull. Ent. Res., III, 203–206, fig. (1912)(7); Fletcher, S. Ind. Ins., p., 454, t. 42 (1914)(8); Willcocks, Ins. Pests Egypt, Vol. I, pt. i, pp. 1-339, 17 figs., 10 tabs. (1916)(9); Gough, Egypt. Agric. Ent. Bull. 4 (1916)(10); Fletcher, Proc. Second Entl. Meeting, pp. 10, 111–114, 127, 129, 130, (1917)(11).

Pectinophora gossypiella, Busck, Journ. Agri. Res. IX, 343-370, t. 7-12 (1917)(12); Ballou, Journ. Ec. Ent., XI, 236–245 (1918)(13).

Platyedra gossypiella, Meyr., Exot. Micr., II. 136 (1918)(14).

This species, the notorious "Pink Bollworm" of cotton, was first described from Western India(1) and there is little doubt but that India was its original home, whence it has been carried in recent years with cotton-seed to most parts of the world, so that it is now very widely distributed and is known to occur in the Straits Settlements, Philippines, Japan (?), Hawaii, Zanzibar, East Africa, Sudan, Egypt, Brazil, Mexico and the Southern United States.

P. gossypiella occurs commonly throughout the Plains of India, Burma and Ceylon and is everywhere a pest of cotton, serious in most localities, especially so in the United Provinces, North-West Frontier Province and Madras. It is especially evident towards the end of the season when a large percentage of the bolls and seeds is attacked. In all districts exotic varieties seem

EXPLANATION OF PLATE XIX.

PLATYEDRA GOSSYPIELLA.

Fig. 1. Eggs, enlarged.
" 2. Young larva.
" 3. Adult larva.
" 4. Pupa.
" 5. Infested cotton-boll.
" 6. Larva inside cotton-seed.
" 7. } Moth.
" 8. }

(The hair-lines show the natural sizes.)

with minute velvety hairs; abdominal segments with similar but longer hairs which are, however, confined to a median transverse belt on each segment; anal segment with cremastral hooks which retain the pupa-case within the cocoon on emergence of the moth. The pupal period is about four days.

The moth flies at night, hiding during the daytime in the soil, in crevices or under clods. It is strongly attracted to light at night. The moth has been found to live for sixteen days in confinement; under natural conditions its life is probably much longer.

The life-cycle is about three weeks, of which the egg stage lasts for twelve to fourteen days, and the pupal stage for four days. Under colder conditions, the cycle may be prolonged to six weeks. Under suitable conditions of temperature and presence of foodplants, this insect seems to breed throughout the year and no regular broods can be distinguished.

PLATYEDRA GOSSYPIELLA, SAUNDERS. (PLATE XIX.)

Depressaria gossypiella, Saunders, T. E. S. (1), III, 285 (1842)(1).

Gelechia gossypiella, Meyr., B. J., XVI, 592, (1905)(2); Wlsm., Faun. Hawaii, I, 731–733 (1907)(3); Lefroy, Ind. Ins. Pests, p. 93, ff. 104-106(4), Ent. Mem., I, 223, f. 69(5), Ind. Ins. Life, p. 534, f. 344 (1909)(6); Durrant, Bull. Ent. Res., III, 203–206, fig. (1912)(7); Fletcher, S. Ind. Ins., p. 454, t. 42 (1914)(8); Willcocks, Ins. Pests Egypt, Vol. I, pt. i, pp. 1-339, 17 figs., 10 tabs. (1916)(9); Gough, Egypt Agric. Ent. Bull. 4 (1916)(10); Fletcher, Proc. Second Entl. Meeting, pp. 10, 111–114, 127, 129, 130, (1917)(11).

Pectinophora gossypiella, Busck, Journ. Agri. Res., IX, 243-370, t. 7–12 (1917)(2); Ballou, Journ. Ec. Ent., XI, 236–245 (1918)(13).

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P. gossypiella occurs commonly throughout the Plains of India, Burma and Ceylon and is everywhere a pest of cotton, serious in most localities, especially so in the United Provinces, North-West Frontier Province and Madras. It is especially evident towards the end of the season when a large percentage of the bolls and seeds is attacked. In all districts exotic varieties seem

most liable to attack. The larva bores into the bolls, feeding on the seeds and spoiling the lint, and also does some damage to buds and flowers when bolls are not available, but when bolls are formed these are much preferred. Many of the attacked bolls drop off and there may be considerable loss of crop from this, or the bolls open prematurely and the fibre is short, dirty and comparatively useless. The oil content of the attacked seed is seriously lessened also, and the germination is affected if the seeds are used for sowing. The loss due to this insect in India alone runs to many millions of Rupees annually.

As noted above, the larva is a serious pest of cotton, but has also been found in India breeding on *Hibiscus abelmoschus*, *Abutilon indicum* and doubtfully on hollyhock. In Egypt and Hawaii it has been bred from *Thespesia populnea* and in Hawaii also from fruits of *Hibiscadelphus hualalaiensis*. In Egypt it has been reared from hollyhock, *Hibiscus esculentus* and *H. cannabinus* and it will probably be found to breed in these foodplants in India also.

Very detailed accounts of the life-history have been given by Willcocks(9) and Busck(12) and reference should be made to their publications for full details. Briefly, the life-history is as follows :—The egg is usually laid on a cotton-boll but may be deposited on a flower or leaf. It hatches in about six days (more or less according to season), and the small yellowish larva, which is very active, either bores into a boll at once, or bores into a flower or nibbles the leaves for a short time before entering a boll. Entered into a boll (or seed-pod, in the case of foodplants other than cotton) it feeds on the seeds, either completely eating out a single seed or nibbling several. It is full-fed after two or three weeks, by which time it is salmon pink and about 12 mm. long, and then emerges from the boll through a circular hole and pupates in a flimsy cocoon usually formed under some shelter on the ground (*e. g.*, under a fallen leaf, flower, clod, etc.). If the lint is picked whilst the larva is still feeding, it emerges when full-fed and may pupate in the lint or in any convenient shelter in the store-room. Rarely pupation takes place inside the boll. In some cases, however, usually towards the end of the season, the larva does not pupate at once, but goes into a resting condition which may last for many months. In the case of larvæ feeding in stored cotton-seed, the larva usually attaches a second seed to the seed in which it is feeding and the presence of these double seeds is a sure sign of infection by this insect. After a variable, but often considerable, interval of time these resting larvæ pupate and emerge as moths. Thus, from larvæ collected at Pusa on 10th November 1907, one larva pupated on 12th March, and emerged on 28th March 1908, whilst another larva of this lot pupated on 4th June and emerged on 13th June 1908. The

following table shows the variation exhibited by larvæ from eggs laid at the same time.

Egg laid	Egg hatched	Larva pupated	Moth emerged
14–X–07	19–X–07	13–XI–07	1–XII–07
17–X–07	23–X–07	12–XI–07	29–XI–07
17–X–07	23–X–07	20–XI–05	9–XII–07
17–X–07	23–X–07	....	30–V–08
18–X–07	24–X–07	14–XI–07	4–XII–07

Some larvæ may, however, enter into a resting stage which lasts for two years or perhaps even longer.

The egg is elongate-oval with rounded ends, about 0·53 mm. long and 0·26 mm. broad, with minute longitudinal (but slightly zigzag) ridges; at first translucent white, looking green against the green background of a leaf or boll, but turning light yellow before hatching, the head of the enclosed larva showing as a large black spot at one end. The young larva does not eat the empty egg-shell.

The newly-hatched larva is about 1 mm. long, cylindrical, tapering posteriorly, yellow; head black, shiny; prothoracic shield dark brown. When about half-grown, it is yellowish-white with pinkish suffusion around the spiracles and tubercles, head chestnut-brown, prothoracic shield brownish. When full-grown it is about 12 mm. long, rather stout, about 2·5 mm. broad, pinkish; head brown; prothorax broad, with a medially divided light brown shield; all segments (except head and anal segment) with a broad salmon-pink ring broken on each side by two delicate light-grey spots which form an interrupted lateral stripe; anal segment with a small shield; hairs moderate.

The pupa is about 6 to 7 mm. long and about 2·6 mm. broad, yellowish-brown, with short brown hairs densely scattered over the surface; anal segment with a black cremastral spine and numerous shorter hair-like hooklets. These cremastral hooks retain the pupa-case inside the cocoon on emergence of the moth.

The moth flies in the evening, after dusk, remaining during the daytime hidden away under any convenient shelter; when disturbed by day, it scuttles along and seeks another shelter, rarely taking to wing. It is attracted to light at night to some extent.

Little is known in India regarding any parasites or other natural enemies of this insect. *Microbracon* sp. and a Bethylid have been reared and at Surat a Braconid was reared and is figured in *Indian Insect Pests* under the name of *Urogaster depressariæ*. In Egypt, Willcocks has given, on pages 233–269 of his monograph (9), a list of the parasites met with, and in Hawaii Swezey has also listed the parasites of this species (*Proc. Hawaii Ent. Soc.*, III, 101–109; 1915). Busck has also published notes on *Parasierola emigrata*, Rohwer (*Insec. Inscit. Menstr.*, V, 3-5; 1917) and Willcocks has recorded an Acarine parasite (*Bull. Soc. Ent. Egypt* 1913, 68–72; 1914), and this last, or a very similar species, also occurs in India.

GELECHIA TAMARICIELLA, Z.

Gelechia tamariciella, Zeller, Stett. Ent. Zeit., 1850, 153 (1); Stainton, Tin. S. Europe, pp. 80-81 (1869)(2); Rebel, Cat. Lep. Pal., ii, 151 (1901)(3).

Telcia tamariciella, Rebel, Iris, XXVI, 90 (1912) (4); Chretien, Ann. S. E. France, 1916, pp. 473–474 (May 1917) (5).

Originally described from Tuscany (1), this species is also recorded from Spain (2), Southern France (3), North Africa, Syria (4), and Egypt (5). In India it appears to be widely distributed throughout the Plains and probably occurs wherever *Tamarix* grows. We have it from Peshawar, Chapra, Pusa and Basra.

In Egypt the larva has been found on *Tamarix*(4) and has been described by P. Chretien(5) and at Pusa it occurs commonly on *Tamarix gallica* and has been collected in February, May and December. The larva feeds on the dry twigs, binding three or four twigs together and residing in the case so formed. It is about 10-11 mm. long and 1·5 mm. broad, tapering posteriorly, reddish-brown; head pale brown, posteriorly irrorated with darker dots, and covered with scattered fine grey hairs; prothorax pale brown; mesothorax deep brown; legs black, brownish apically; warts I and II black, emitting three or four short black hairs; lateral tubercles similar but larger, an ill-defined dark dorsal line bordered by minute white dots; five pairs of prolegs. In another larva the head and thorax were described as green, other segments dull brown, green ventrally.

The larva seldom emerges from its case which it sometimes carries about with it, retreating inside when disturbed. It is therefore easily overlooked. In captivity pupation took place inside a flimsy cocoon formed by fastening three or four twigs together and attaching them to the bottom of the cage. The pupal period is about eight days in May and fifteen days in February. (Pusa Insectary Cage-slips 644, 1052, 1171.)

STEGASTA VARIANA, MEYR.

Stegasta variana, Meyr., Proc. Linn. Soc. N. S. W., XXIX, 314 (1904)(1), B. J., XVII, 140 (1906)(2), Ann. Transvaal Mus., II, 12 (1909)(3), *l. c.*, III, 65 (1911)(4), Entom. Mitteil. Suppl., III, p. 50 (1914)(5).

Originally described from Eastern Australia(1) and afterwards from Ceylon (2), South Africa(3, 4) and Formosa (5), this species is widely distributed in India and Ceylon, and we have it from Peradeniya, Coimbatore, Bassein Fort (Bombay), Hoshangabad, Katni (Central Provinces), Palamau, Cuttack, Pusa and Shillong. It has been reared at Pusa from larvæ found webbing, and sometimes rolling, leaves of *chakwar* (*Cassia tora*) and *chameli* (*Jasminum* sp.). The larva usually binds together two leaves, one above another, and lives in the shelter so formed, feeding on the epidermis and mesophyll substance, and leaving a thin layer of one epidermis.

The full-grown larva is 8 to 9 mm. long, cylindrical, slightly tapering posteriorly, segments distinct, green (becoming pink before pupation); head flattened, black, shiny, smaller than prothorax; prothorax smaller than mesothorax, wholly covered above by a black, shiny shield, ventrally black with a pinkish tinge; mesothorax black with a pinkish tinge or (in other specimens) reddish-brown; legs black; tubercles small, black, emitting short grey hairs; five pairs of equally developed prolegs.

Pupation takes place in a sort of cocoon formed by lining the larval shelter with a thin layer of silk. The pupa is about 4 to 4·5 mm. long, brown, anal segment with thin cremastral hooks which hold the pupa-case within the cocoon on emergence of the moth. The pupal period is five or six days in October. (Pusa Insectary Cage-slips 608, 803.)

ONEBALA BLANDIELLA, WLK.

Onebala blandiella, Wlk., XXIX. 792 (1); Wlsm., in Swinh., Cat. Lep. Het. Oxf. Mus., II, 545 (1900) (2); Meyr., T. E. S., 1894, 16 (3).

"Larva greenish, naked, about an inch long. Leaf-roller on a common species of dead-nettle at Ootacamund. Imago emerges in February(2)."

Also recorded from Ceylon(1) and Burma (Mone)(3).

ZALITHIA DILUTICORNIS, WLSM.

Cryptolechia diluticornis, Wlsm. in Moore's Lep. Ceylon, III, 519, t. 209, f. 7 (1887)(1).

Pachnistis diluticornis, Meyr., B. J., XX, 707 (1911)(2).

We have this from Surat (where it was reared from a larva on dry cotton-stalks), Chapra, and Pusa.

This species has been reared at Pusa from larvæ found on 25th January 1906 under *gular* (*Ficus glomerata*) bark, and from larvæ found on 27th January 1917 amongst dry fallen leaves. The larva feeds on dry leaves. It is about 15 mm. long, cylindrical, greyish, clothed with black hairs so densely that the segments are not distinguishable and the larva looks like a mass of hairs; many hairs are longer and rise above the dense mass, these longer hairs being greyish: head black, shiny: five pairs of equally developed greyish prolegs; legs black. Pupation takes place within the cavity formed by dead dry leaves which have rolled up to some extent, in a blackish cocoon in which all the hairs from the body of the larva have been knitted. The moths emerge in March after a pupal period of four or five weeks. (Pusa Insectary Cage-slips 290, 1529.)

THYRSOSTOMA GLAUCITIS, MEYR.

Thyrsostoma glaucitis, Meyr., B. J., XVII, 736 (1907)(1), Exot. Micr., II, 120 (1918)(2).

Described from Peradeniya where it was reared "from mango leaf"(1).

Besides Ceylon, received from Coorg, Kanara and Assam; attached to mango, apparently common(2).

DACTYLETHRA CANDIDA, STT.

Anarsia candida, Stainton, T. E. S. (n. s.) V, 114-115 (1859)(1).

Dactylethra candida, Meyr., B. J., XXII, 167 (1913)(2).

Originally described from Calcutta(1). Doubtless widely distributed in the Plains. We have it from Adoni, in the Bellary District, where it was reared from a larva making galls in stems of *Tephrosia purpurea* in August 1912, from Koilpatti where the larva was found causing galls on tender shoots of a wild indigo in August 1907, and from Manganallur, where it was bred in September 1917 from wild indigo.

LECITHOCERA CRYPSILYCHNA, MEYR.

Brachmia crypsilychna, Meyr., B. J., XXII, 773-774 (1914)(1).

Lecithocera crypsilycha, Meyr., Exot. Micr., II, 103 (1918)(2).

Described from Bassein Fort, Bombay. The larva was found between spun leaves of *Ipomœa arvensis*(1).

LECITHOCERA EFFERA, MEYR.

Lecithocera effera, Meyr., Exot. Micr., II, 104 (1918)(1).

Bred at Coimbatore from larva feeding on leaves of sweet-potato (*Ipomœa batatas*) in September. Pupa-case clothed with scattered erect hairs, a curious

feature ; four segments free. Also recorded from Surat(1). It has also been reared at Coimbatore on 9th June 1913 from a pupa found on horse-radish.

BRACHMIA ENGRAPTA, MEYR.

Brachmia engrapta, Meyr., Exot. Micr., II, 114 (1918)(1).

Bred at Lahore in July from larva on sweet-potato (*Ipomœa batatas*). Also found at Coimbatore in October(1).

BRACHMIA AROTRÆA, MEYR.

Cladodes arotræa, Meyr., T. E. S., 1894, 15(1).
Brachmia arotræa, Meyr., B. J., XX, 723 (1911)(2).

This species was originally described from Koni (Burma)(1) and has since been recorded from Ceylon(2), the Khasi Hills(2) and Southern India(2). It seems to be widely distributed throughout India, Burma and Ceylon.

It " has been bred in small numbers from larvæ on rice leaves at Pusa and Katni (Central Provinces). We have it also from Cuttack and Palamau and it occurs in Burma and Ceylon. It is therefore likely to be found on paddy in most districts but is not a pest, so far as we know." (Proc. Sec. E. M., p. 164.) It has also been reared at Samalkota on paddy.

A larva was found at Pusa on 17th September 1907, rolling a rice leaf to form a shelter inside which it lives, feeding on the leaf and filling the roll with excrement. The full-grown larva is about 9 mm. long, cylindrical, tapering posteriorly, light green ; head shiny black, labrum reddish-brown ; prothorax with a shiny, black shield ; mesothorax with a black subdorsal dot ; metathorax with a thick black shield ; legs black, shiny ; abdominal segments with a light green dorsal stripe and several more or less interrupted lateral stripes ; primary hairs few, dark ; five pairs of dull white prolegs. Pupation takes place within the larval shelter. The pupa is 5 mm. long, cylindrical, tapering poster-riorly, brown. The pupal period is about six days. (Pusa Insectary Cage-slip 602.)

BRACHMIA IDIASTIS, MEYR.

Brachmia idiastis, Meyr., Exot. Micr., I, 577 (June 1916)(1).

Described from Pusa, where it was bred in June from larva feeding on *Panicum* sp.(1).

Larvæ were found at Pusa on 5th April 1910 and 25th May 1914, rolling leaves of *Panicum* sp. The larva rolls a leaf longitudinally by folding the margins together, living inside the shelter so formed and eating the epidermis and also the mesophyll substance of the leaf, leaving entire one epidermal layer which turns yellow.

The larva is about 10 mm. long when extended and about 1 mm. broad, segments distinct, light yellow; head black, shiny; prothorax with a shiny black shield divided medially by a narrow white line; mesothorax dark dorsally; metathorax and first abdominal segment wholly blackish; second and following abdominal segments with a broad black submedian stripe, from which on the anterior part of each segment arises a narrower black marking which runs obliquely downwards to the posterior part of the segment; hairs short, black, scattered; legs black, shiny; five pairs of equally developed yellow prolegs.

Pupation takes place in a cocoon formed by twisting a leaf around twice to form a tube which is lined with a thin layer of silk. The pupal period is about five days. (Pusa Insectary Cage-slips 832, 1063.)

BRACHMIA INSULSA, MEYR.

Brachmia insulsa, Meyr., B. J., XXII, 774 (1914)(1).

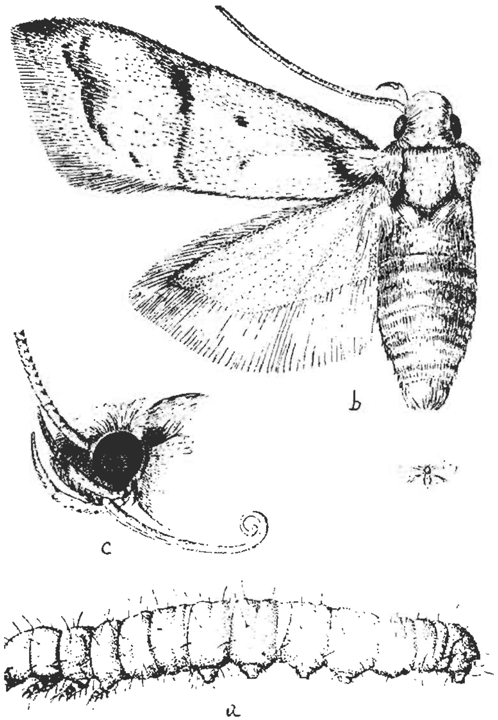
This species was originally described from Pusa and we have it from Peshawar, Abbottabad, Pusa and Belgaum. It appears to be common throughout the Plains of India. At Pusa the moths are abundant in May and June and occur in smaller numbers in February and March.

It has been reared at Pusa from a larva found on 1st February 1910 on potato. The larva rolls a leaf or binds two leaves together with silk threads, living in the shelter so formed and nibbling small holes in the leaf. When full-grown the larva is about 14 mm. long, cylindrical, pink with a dark tinge: head shiny, dark brown, posteriorly almost black; prothoracic shield large, prominent, black, shiny; thoracic segments dark; segments with scattered hairs; five pairs of equally developed prolegs. Pupation takes place in a cocoon formed by lining the larval shelter with white silk. The pupa is about 6 mm. long, brown, the anal extremity prolonged into a flattened, pointed process bearing two long thin stiff divergent hairs. (Pusa Insectary Cage-slip 827.)

BRACHMIA XEROPHAGA, MEYR. (PLATE XX, FIG. 1.)

Brachmia xerophaga, Meyr., Ent. Mo. Mag. 1914, 219–220(1).

The larva, dark red in colour, occurs in nests of *Stegodyphus sarasinorum*, and doubtless feeds on the fragments of the numerous insects caught in the webs; the pupa is also found in the nest, as is the moth itself. The latter may be seen resting on the outside of the web-nest or running freely into the galleries leading to its interior(1).



Brachmia xerophaga: *a.* Larva (x 13); *b.* moth, natural size and [m]agnified (x 13); *c,* head of moth, from side, magnified (x 22).

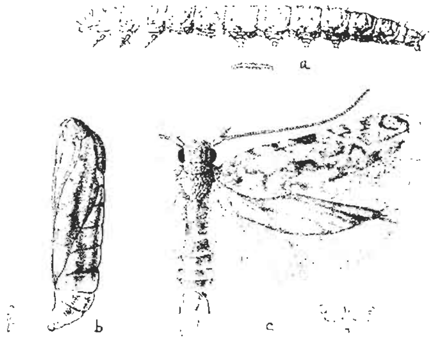


Fig. 2. *Inarsia ephippias*: *a.* Larva; *b.* pupa; *c.* moth, natural sizes and magnified (x 8).

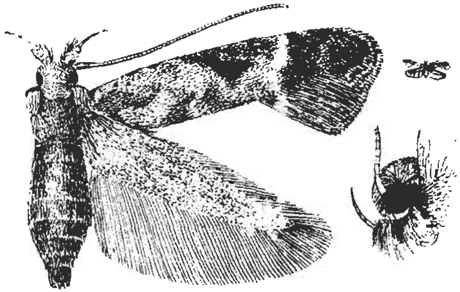


Fig. 3. *Inarsia melanoplecta*: Moth, natural size and magnified, with a more highly magnified side-view of the head.

Described from specimens from Guindy, Madras[1]. Also found by Dr. Gravely at Puri, Orissa.

HELCYSTOGRAMMA HIBISCI, STT.

Gelechia ? hibisci, Stainton, T. E. S. (n. s.) V, 117[1].

Gelechia ? hibisci, Snell., Tijd. voor Ent., XLVI, 43–44, t. 5, ff. 3, 4[2].

Strobisia hibisci, Meyr., B. J., XX, 732 (1911)[3].

Helcystogramma hibisci, Meyr., T. E. S., 1914, 270[4].

Helcystogramma obseratella, Zeller, H. S. E. R., XIII, 371–373, t. 5, f. 127, (1877)[5].

Larva small, green, with the head black; it feeds on the tops of the yellow *Hibiscus*[1]; on *Hibiscus*[1].

Widely distributed throughout India and Ceylon. We have it from Pusa, Nagpur, Pollibetta (Coorg) and Shillong.

Outside of India it has been recorded from Java by Snellen[2], and " probably from Cuba " by Zeller[5], this latter record being perhaps in error.

The larva was found at Pusa on 17th September 1907, rolling leaves of *Hibiscus esculentus*. The larva was described as about 12 mm. long, cylindrical, slightly tapering posteriorly, yellowish-green; head shiny black, with scattered minute whitish hairs, labrum greyish-red, antennæ prominent; prothoracic shield black, shiny; body segments distinct; warts small, dark, emitting a short whitish hair, five pairs of prolegs.

Pupation takes place in a cocoon spun amongst loose leaves. The pupa is brown, cylindrical, broad apically, tapering posteriorly, dorsal and lateral areas with short hairs; anal segment with four cremastral hooks which are entangled in the silken threads of the cocoon and which retain the pupa-case inside the pupal shelter on emergence of the moth. The pupal period is five or six days. (Pusa Insectary Cage-slip 601.)

AUTOSTICHA AUTHÆMA, MEYR.

Epicœnia authæma, Meyr., B. J., XVII, 141 (1906)[1].

Described from Peradeniya, where the larva, in a heliciform case, feeds on moss-covered rocks[1].

This is a Ceylonese species, not yet found in India.

AUTOSTICHA CHERNETIS, MEYR.

Epicœnia chernetis, Meyr., B. J., XVII, 141 (1906)[1].

Autosticha chernetis, Meyr., B. J., XVII, 459[2].

Recorded from Peradeniya, where the larva lives in galleries on moss-covered rocks[1].

AUTOSTICHA EXEMPLARIS, MEYR.

Autosticha exemplaris, Meyr., Exot. Micr., I, 586–587 (June 1916)([1]).

Described from Coimbatore, where it was bred in October, together with various other Lepidoptera, from refuse in the fork of a tamarind-tree. It is doubtful whether the present species is a refuse-feeder, it may only have entered for pupation or been carried in with leaves; the known Ceylon larvæ of this genus are lichen-feeders; on the other hand, the Hawaiian species, *pelodes*, is a refuse-feeder and it is therefore possible that *exemplaris* may be one also.

One of the specimens reared at Coimbatore from this lot was a teratological example, with two small duplicate hindwings on the right side. This specimen has been placed in the British Museum (Natural History) Collection.

AUTOSTICHA PROTYPA, MEYR.

Autosticha protypa, Meyr., B. J., XVIII, 457–458 (1908)([1]).

Described from Ceylon (Maskeliya, Maturatta, and Peradeniya), where the larva lives in galleries on lichen on rocks([1]).

PARASPISTES PALPIGERA, WLSM.

Gelechia palpigera, Wlsm., T. E. S. 1891, 94, t. 4, f. 31 (1891)([1]).

Paraspistes ioloncha, Meyr., B. J., XVI, 600 (1905)([2]), Tr. Linn. Soc. (2) XIV, 274 (1911)([3]).

Lipatia crotalariella, Busck, Bull. Dept. Trinidad, IX, 243 (1910)([4]).

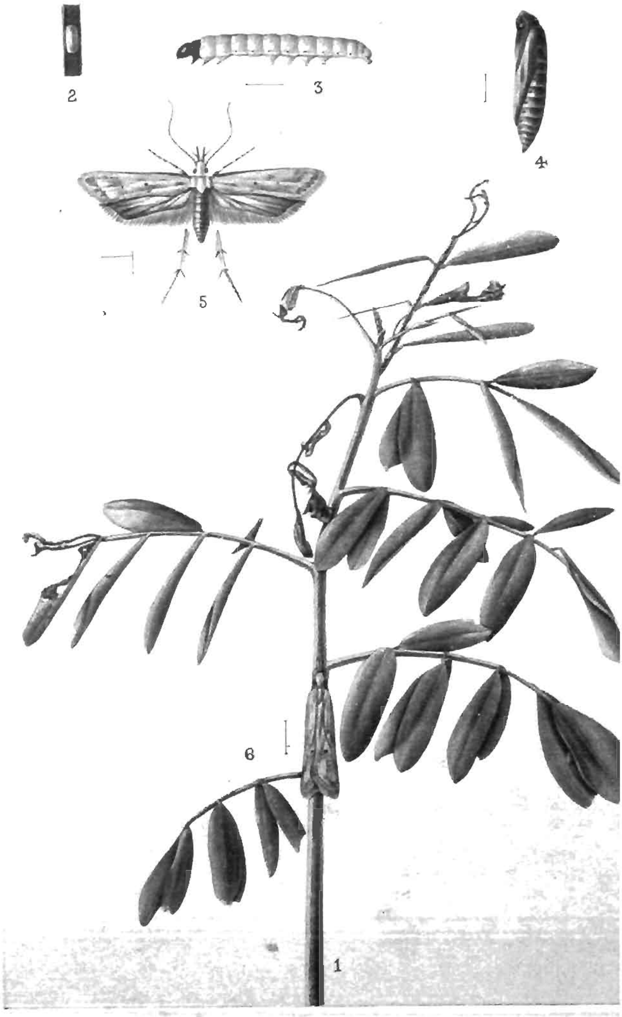
Paraspistes palpigera, Busck, Proc. U. S. Nat. Mus., XLVII, 10-11 (Apl. 1914)([5]).

Originally described from Delagoa Bay, East Africa([1]), this species has been reared at Coimbatore in August and September 1916, in some numbers in indigo pods and also from larvæ in pods of *Cassia corymbosa* and *Cassia flora*. At Manganallur it was also reared from wild indigo. We have this species from Puttalam (Ceylon), Pollibetta (Coorg), Coimbatore, Manganallur, and Bhamo (Burma), and it has also been recorded from Peradeniya([2]), where it was reared in July from pods of *Crotalaria*([2]), from the Seychelles([3]), from the British West Indies([4, 5]), where the larva was also found in pods of *Crotalaria*([4]), and from the Bahamas([5]), and Panama([5]).

HYPELICTIS ALBISCRIPTA, MEYR.

Hypelictis albiscripta, Meyr., B. J., XXII, 773 (1914)([1]).

Reared in North Kanara from pupa found between closely-spun leaves of *Salix*([1]).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EXPLANATION OF PLATE XXI.

DICHOMERIS IANTHES.

Fig. 1. An affected Java-Natal indigo plant.
" 2. Egg, enlarged.
" 3. Caterpillar, enlarged.
" 4. Pupa, enlarged.
" 5. } Moth in flying and resting attitudes.
" 6. }

(The hair-lines show the natural sizes.)

STROBISIA AMETHYSTIAS, MEYR.

Zalithia amethystias, Meyr., B. J., XVII, 140 (1906)([1]).
Strobisia amethystias, Meyr., B. J., XX. 726([2]), Exot. Micr., II, 144 (1918)([3]).

Originally described from Peradeniya([1]).

" Bred from a larva feeding in fungus-bed of Termites' nest (*Green*) "([3]).

TRICHOTAPHE GEOCHROTA, MEYR.

Trichotaphe geochrota, Meyr.: B. J., XXII, 775 (1914)([1]).

This species was reared from a larva found on leaves of an unidentified plant at Bassein Fort (Bombay) on 1st October 1909. The larva was described as about 8 mm. long, tapering towards either extremity, creamy white; head yellowish; prothorax with a minute reddish dot on side just below head, a yellowish dorsal band, and below this band two yellowish dots on side, mesothoracic and following segments with a light chocolate-coloured dorsal band nearly complete and straight on mesothorax and metathorax but slightly curved on abdominal segments; these bands on abdominal segments (except on anal segment) are not complete, being interrupted dorsally, and bear two black dots on their ends; legs pointed, creamy; five pairs of prolegs, rather blunt, anal prolegs directed slightly posteriorly. Pupation took place under shelter of a leaf fastened to the bottom of the cage. The pupa was slightly over 5 mm. long, yellowish-brown. The pupal period was six days. (A. Mujtaba's Cage-slip 63.)

DICHOMERIS IANTHES, MEYR. (PLATE XXI.)

Hypsolophus ianthes, Meyr., T. E. S., 1887, 273–274([1]).
Ypsolophus ochrophanes, Meyr., B. J., XVII, 981 (1907) ([2]); Lefroy, Ind. Ins. Life, pp. 533–534 (1909)([3]), Agricl. Jl. Ind., V, 161–162([3]*a*).
Ypsolophus ianthes, Meyr., Rec. Ind. Mus., V, 223([4]), Tr. Linn. Soc. (2) XIV, 275 (1911)([5]).
Dichomeris ianthes, Meyr., B. J., XXII, 172 (1913) ([6]), Entom. Mitteil. Suppl., III, p. 51 (1914)([7]); Fletcher, S. Ind. Ins., pp. 456–457, f. 332 (1914)([8]); Rutherford, Tropl. Agric., XLIII (Sept. 1914) ([9]); Proc. Second Entl. Meeting, pp. 61, 80 (tab.), 207 (1917)([10]).

Widely distributed in India and Ceylon, extending to Reunion ([1, 5]) and the Seychelles([5]) and Formosa([7]). Apparently not yet recorded from Burma. We have specimens from Champaran, Gondra, Muhammadpur, Pusa, Dalsing Serai, Bassein Fort, Palur and Mercara.

Larva described by Lefroy[3] *and Fletcher*[8]. *Feeds on Medicago*[5], *Cyamopsis*[5,10], and is a pest of indigo[3, 8, 10] and lucerne[5, 9, 10].

This species is quite of minor importance as a rule but in 1909 it appeared in the Champaran District as a serious pest of Java indigo and did considerable damage, as is instanced in the following report :—"The caterpillars seem to have made a pretty clean sweep of the field attacked ; there are very few plants unattacked, practically all have their leaves reduced to a dirty brown powder and many are merely bare sticks," young plants only a few inches high being attacked in August, September and October, the caterpillars webbing up the leaves at the top of the young shoot, feeding on them, and checking the growth of the plant.

In confinement, a female moth laid 37 eggs between 8th and 10th October 1909. The egg is elongate-oval, cylindrical with rounded ends, about 0·5 mm. long, light green when laid, gradually becoming yellowish, and pinkish just before hatching. The eggs are usually laid in the groove of the petioles of the leaves and nearly always on leaves near the top of the plant. On *guar* eggs were deposited alongside the raised veins on the under-surface of the leaf. The eggs may be deposited singly or as many as six in one place ; when several are laid, they usually lie lengthwise in the groove, touching each other. The larva hatches out after about four days, and does not eat the egg-shell.

The newly-hatched larva is about 0·75 mm. long, cylindrical, light yellow with a greenish tinge ; head larger than other segments, shiny, dark red brown ; prothoracic shield shiny, reddish-brown ; primary hairs comparatively long ; five pairs of equally developed prolegs.

The full-grown larva is about 7 mm. long and slightly more than 1 mm. broad, green ; head shiny black ; prothorax black, with a large shiny black shield ; prothoracic legs black, mesothoracic and metathoracic legs green ; minute hairs scattered over segments ; five pairs of equally developed prolegs.

On hatching from the egg the larvæ usually crawl onto the tender top-leaves, fold a leaf, live hidden inside it and so feed. They bite the leaf usually from the edge and go on eating until little is left to afford a shelter, then they leave the leaf and go to another. The leaf thus eaten withers and dries up. As they grow larger they bind two or three, or more, leaves together, the leaves retaining their flat shape. The larval life is about fifteen days.

Pupation takes place either between two leaves fastened together or in a rolled leaf or in the larval shelter of top-leaves bound together, the interior of the shelter being lined with a thin layer of silken fibre. The pupa is about 5 mm. long, cylindrical, tapering to a point posteriorly, brown ; the anal extremity prolonged into a process from the apex as well as from the base of

which arise many stiff brown circinate hairs which are entangled in the fibres of the cocoon. The pupal period is about six days. The whole life-cycle is thus about 25 days. (Pusa Insectary Cage-slip 796.)

DICHOMERIS EVIDANTIS, MEYR.

Ypsolophus evidantis, Meyr., B. J., XVII. 981 (1907)(¹).
Dichomeris evidantis, Meyr., B. J., XXII. 172 (1913)(²).

Described from Pusa, in April and May. The larva rolls a green leaf of *Dalbergia sissu* or more commonly fastens together two leaves, living inside the shelter thus formed and nibbling the epidermis or gnawing holes in the leaves. The larva is about 24 mm. long and 2 mm. broad, slightly flattened, pale greenish yellow, the deep green dorsal vessel showing as a stripe; head flattened, yellow, speckled with brownish; prothoracic shield large, pale yellow; two faint interrupted submedian stripes and a similar subspiracular stripe; spiracles round, rimmed with black; primary hairs rather long; five pairs of equally developed prolegs. Pupation takes place in a white silken cocoon formed inside the larval shelter. Pupa brown, anal segment rather prolonged and armed with eight circinate hairs, which are entangled in the fibres of the cocoon, inside which the empty pupa-case remains on emergence of the moth. (Pusa Insectary Cage-slips 680, 896, 995.)

ANARSIA ACERATA, MEYR.

Anarsia acerata, Meyr., B. J., XXII, 169 (1913)(¹).

This species, originally described from North Coorg(¹), was reared at Saidapet, Madras, on 10th October 1906, from a larva found on *Cajanus indicus*.

ANARSIA ALTERCATA, MEYR.

Anarsia altercata, Meyr., Exot. Micr., II, 148 (1918)(¹).

" Bred at Pusa in July from pupa in rolled leaf of *Sesbania*"(¹).

ANARSIA DIDYMOPA, MEYR.

Anarsia didymopa Meyr., Exot. Micr., I, 583 (1916)(¹).

This was reared at Pusa on 23rd July 1908 from a pupa found on 18th July attached to the back of a leaf of *bagnahi* (*Capparis horrida*) and covered with another piece of leaf. The pupa was a little more than 4 mm. long, slightly tapering posteriorly, segments distinct, reddish-brown, wings reddish-yellow. (A. Mujtaba's Cage-slip 46.)

ANARSIA EPHIPPIAS, MEYR. (PLATE XX, FIG. 2.)

Anarsia ephippias, Meyr., Ent. Mo. Mag., XLIV, 197 (1908)(1); Lefroy, Ind. Ins. Life, p. 534, t. 56 (1909)(2); Proc. Second Entl. Meeting, pp. 51, 53, 91 (1917)(3); Fletcher, Ann. Rept. Impl. Entom., 1917–18, pp. 103–104 (1918)(4).

This species is widely distributed in the Plains of India. In Bihar it has been found at Pusa, Chapra, Paddankaii and Gondra; at Paddankaii (Champaran) and Gondra the larva occurred on indigo and at Pusa it has been found on groundnut, soybean, *moth*, *urid* and *mung*. In Southern India it has been noted at Saidapet (larva on *Cajanus indicus*), and at Virajpet, in South Coorg (larva on flowers of *Acacia* sp.). In the Punjab Madan Mohan Lal has recorded it as a fairly bad pest of groundnut(3), but I have seen no specimens from the Punjab. At Mandalay also K. D. Shroff has found a small larva, perhaps of this species, boring top-shoots of *urid*(3). At Pusa it is usually a minor pest of the crops mentioned above, the larva rolling the top-shoots and boring into the flower-buds, flowers and pods and eating the seeds.

It may be noted that many closely-allied species of *Anarsia* occur in India and that many of these are attached to leguminous crops, so that careful discrimination of the species is necessary.

The larva ties together with silk the top-leaves, flower-buds or flowers on which it is feeding. When full-grown it is about 10 mm. long and about 1·75 mm. broad across mid-body, rather flattened, segments distinct, dark red-brown, deep pinkish-brown, or dark purple; head rather flattened, yellow-brown, shiny; prothoracic shield large, yellow-brown; primary hairs short, arising from slightly raised tubercles; legs black; five pairs of equally developed prolegs.

Pupation takes place amongst the flowers or inside a rolled leaf. The pupa is about 5 mm. long, red-brown, anal extremity with a number of short circinate hairs on ventral surface and a few much longer hairs on apex. The pupal period is about five days in July and nine or ten days in November. (Pusa Insectary Cage-slips 72, 918, 1637.)

ANARSIA EPOTIAS, MEYR.

Anarsia epotias, Meyr., Exot. Micr., I, 583 (June 1916)(1).

Described from Pusa, where it has been reared from larvæ found in *Tamarix* twigs on 10th May 1914.

The larva webs several green twigs together lengthwise and lives hidden and feeds from within. The larva is about 12 mm. long, cylindrical, pale

greenish-yellow; head dark brown, shiny; prothorax with dorsal dark brown shiny shield, ventrally dark brown; tubercles on segments minute black points emitting short grey hairs; five pairs of prolegs. Pupation takes place in a white silken cocoon formed inside the larval shelter. Moths have been bred in March and May. (Pusa Insectary Cage-slips 1054, 1180.)

ANARSIA EXALLACTA, MEYR, MS.

This species was reared at Pusa on 7th October 1912 from at larva found on top leaves of *arhar* (*Cajanus indicus*).

ANARSIA IDIOPTILA, MEYR.

Anarsia idioptila, Meyr., Exot. Micr., I, 582-583 (June 1916)(1).

Described from Pusa, where it was taken from *Cassia fistula* in June(1).

This species was reared from a larva found at Pusa on 8th June 1913, folding or binding together several leaves of *Casssia fistula*, living hidden and feeding on the leaves from within its shelter. The larva is about 7 mm. long, flattened, light greenish-yellow with a broad brown subdorsal stripe; head flattened, yellowish brown; thoracic segments blackish; five pairs of prolegs. Pupation takes place within the larval shelter, the cremastral hooks of the pupa being fastened into a thin silken lining attached to one leaf. The pupa is about 4·5 mm. long and about 1·5 mm. broad across thoracic region, cylindrical, tapering to a point anally, dark brown, shiny. The pupal period is about five days in June. (Pusa Insectary Cage-slip 996.)

ANARSIA MELANOPLECTA, MEYR. (PLATE XX, FIG. 3.)

Anarsia melanoplecta, Meyr., B. J., XXII, 774 (1914)(1); Fletcher, Entl. Note 78 (1916)(2); Proc. Second Entl. Meeting, p. 221 (1917)(3).

Larva boring in shoots of mango (*Mangifera indica*) in May at Pusa.

This species is probably widely distributed, but overlooked. We have it from Pusa and Nagpur. At Pusa it has been found boring mango buds and twigs and feeding on mango inflorescence and at Nagpur it has been reared from mango flowers.

The larva has been described as " about 8 mm. long by 1 mm. in breadth; cylindrical, the segments well defined, in colour yellow with a pinkish tinge, the anal segment darker. The head and prothorax slightly smaller than the metathorax which is the broadest part of the body. The head is shining black, the prothorax dark grey with a prominent black shiny shield divided medially by a fine line. Five pairs of equally developed prolegs are present." The above larva was found at Pusa on 19th February 1912, boring the terminal shoot of a tender twig of mango.

The foregoing description agrees substantially with a description of another larva found at Pusa on 2nd May 1906, boring into a mango twig. The larva bores into the twig from the tip until it reaches a limit of the new year's growth, and there it makes a silken lining to the chamber it has excavated and also provides an opening for the emergence of the imago. (Y. Ramachandra Rao's Cage-slip 27.)

ANARSIA OMOPTILA, MEYR.

Anarsia omoptila, Meyr., Exot. Micr., II, 147 (1918)(1).

"Bred at Coimbatore in October from larvæ feeding between folded leaves of *Cajanus indicus*"(1).

ANARSIA SAGITTARIA, MEYR.

Anarsia sagittaria, Meyr., B. J., XXII, 774–775 (1914)(1).

Described from Pusa(1), where it has been reared from larvæ boring top-shoots of *ber* (*Zizyphus jujuba*) in August 1907 and June 1908, but no description of the early stages seems to have been made.

ANARSIA SAGMATICA, MEYR.

Anarsia sagmatica, Meyr., Exot. Micr., I, 582 (1916)(1).

This species has been reared at Pusa from a larva found on 16th February 1914, rolling the apical part of a *Loranthus* leaf transversely and fastening it into a cylindrical fold with white silk. The larva was living within this fold and nibbling the leaf from within its shelter. The larva was about 8 mm. long and a little more than 1 mm. broad across mid-body, slightly flattened, slightly tapering towards either extremity, uniform coppery-brown, the thoracic region darker, head shiny yellow-brown; segments not clearly marked, skin soft and smooth, small scattered hairs arising from minute papillæ; legs dull black; five pairs of equally developed prolegs. Pupation took place in a cocoon formed by lining the larval shelter with white silk. The larva pupated on 21st February, and the moth emerged on 7th March. (Pusa Insectary Cage-slip 1029.)

ANARSIA VERUTA, MEYR.

Anarsia veruta, Meyr., Exot. Micr., II, 148 (1918)(1).

"Bred at Pusa in February from pupa on *Inga dulcis* (Leguminosæ)"(1).

CHELARIA PHACELOTA, MEYR.

Chelaria phacelota, Meyr., B. J., XXII, 166 (1913)(1), Exot. Micr., I, 279 (1914)(2).

Recorded from Peradeniya(1, 2), where it was bred in July from Psyllid galls on *Mallotus philippinensis*(2).

CHELARIA RHICNOTA, MEYR.

Chelaria rhicnota, Meyr., Exot. Micr., I, 580–581 (June 1916)(1).

Described from the Shevaroy Hills and from Chittur, Madras Presidency(1).

Bred in February from larva found feeding on flowers of *Mangifera indica* at Chittur; the pupa with five abdominal segments fixed(1).

CHELARIA SCOPULOSA, MEYR.

Chelaria scopulosa, Meyr., B. J., XXII, 165–166 (1913)(1), *l. c.*, 774 (1914)(2).

Described from Karwar, where the larva was found burrowing in shoots of *Careya arborea*, showing some excrement on opening of bole(1).

CHELARIA SPATHOTA, MEYR.

Chelaria spathota, Meyr., B. J., XXII, 165 (1913)(1); Fletcher, Entl. Note 82 (1916)(2), Proc. Second Entl. Meeting, p. 219 (1917)(3).

Described from the Khasis and Konkan(1). It was reared at Pusa in December 1909 from a larva found eating mango leaves. It has also been reared from a larva found on tender mango leaves at Koilpatti, Madras Presidency in November 1909(2). No description of the early stages seems to have been made.

ÆCIA ŒCOPHILA, STDGR.

Macroceras œcophila, Stdgr., Stett. Ent. Zeit. 1876. 150(1).
Æcia maculata, Wlsm., P. Z. S., 1897, 11–112(2), Fauna Hawaii, pp. 649-650(3).
Æcia œcophila, Meyr., T. E. S., 1915, 201(4).

Recorded from Sicily(1), West Indies(2), Brazil(2), Peru(4), Hawaii(3) and India(4). We have specimens from Pusa and Coimbatore. The moth occurs on the walls of houses and the larva is probably a domestic rubbish-feeder. We have it from Pusa ("on bee blanket"), Coimbatore ("on a wall"), and Belgaum.

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA

IV. COSMOPTERYGIDÆ, ŒCOPHORIDÆ, PHYSOPTILIDÆ, XYLORYCTIDÆ, STENOMIDÆ AND ORNEODIDÆ

BY

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Imperial Entomologist

AGRICULTURAL RESEARCH INSTITUTE, PUSA

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(Received for publication on 27th June 1919.)

METACHANDIDÆ.

This family is typical of the Mascarene area, one species (*Metachanda crocozona*, Meyr.) being recorded from Assam and a few others from South Africa. Nothing seems to be known of the early stages of this group.

COSMOPTERYGIDÆ.

ANATRACHYNTIS SIMPLEX, WLSM.

Pyroderces simplex, Wlsm., T. E. S., 1891, 119-120, t. 6, f. 58 (1); Durrant, Bull. Ent. Res., III, 206-207, f. 2 (1912) (2); Lamborn, *l.c.*, V, 201 (1914) (3); Willcocks, Ins. Pests Egypt, I, i, 317-320, t. 7, ff. 7-9 (1916(3a).

Batrachedra coriacella, Snellen, Tijds. v. Ent., XLIV, 95, t. 6, f. 17 (1901)(4).

Stagmatophora gossypiella, Wlsm., A. M. N. H. (7), XVIII, 178-179 (1906(5); Morstatt, Pflanzer, VIII, 253 (1912)(6).

Stagmatophora coriacella, Lefroy, Ind. Ins. Life, p. 536 (1909)(7); Meyr., T. E. S., 1910, 372(8).

Pyroderces coriacella, Fletcher, S. Ind. Ins., pp. 458-459, f. 334 (1914)(9); Meyr., Entom. Mitteil. Suppl., III, p. 52 (1914)(10).

Anatrachyntis coriacella, Meyr., Exot. Micr., I, 325 (1915)(11).

Anatrachyntis simplex, Fletcher, Proc. Second Entl. Meeting, p. 114 (1917)(12).

Larva in cotton-seed (2, 3, 3a, 4, 5, 6, 7, 8, 9), in India (7, 8), Burma(7), Java(4), Formosa(10), Mauritius(8), E. Africa(6), Egypt(2, 3a, 5), and West Africa(1, 3). Described by Lefroy(7) and Willcocks(3a).

"*Stagmatophora coriacella*, ... can be bred in abundance from dry cotton seeds left too long on the plant. The caterpillar is red, not unlike that of *Gelechia gossypiella*, only smaller and is not found in the green boll or in unripe seed, as is the latter, and is not destructive. We have reared this from cotton-seed from many parts of India, and I. H. Burkill sent it in from Amherst, Burma"(7).

Willcocks gives(3a) the following more complete description of the early stages and figures the full-grown larva and pupa [erroneously referred to on the plate as *P. gossypiella*] :—

"*Egg*. Very minute, oval, convex, measuring about 0·36 mm. long by 0·22 mm. wide, the shell longitudinally striated. Laid on damaged ripe cotton bolls and the exposed parts of the interior.

"*Larva*. The larvæ feed on the injured seeds and fibre and general debris to be found in bolls which have been attacked by bollworms. At first the larvæ are white with a brownish head; later and whilst still quite small, they may become pinkish or sometimes they will be found to be quite dark-coloured owing to their having fed on dark coloured decayed matter, which shows through the somewhat transparent skin; or again, the skin may be covered and thus discoloured by the spores of the black sooty fungus frequently present in damaged cotton-bolls late in the year. When full-grown the larva (Plate VII, fig. 9) measures some 7 to 8 mm. long by 1·5 mm. broad. The head is light yellowish-brown and the thoracic shield is of the same colour but paler. The body is pale or slightly yellowish with two conspicuous and very distinct reddish-pink transverse and narrow bars on the back of each segment. The transverse barrings are so distinct that this character alone serves to distinguish the *Pyroderces* larva from the pink bollworm [*Gelechia gossypiella*], in which the reddish-pink colour is much more generally suffused over the dorsum; and moreover, *Gelechia* larvæ of the size of the *Pyroderces* larva are, generally speaking, still white or white with faint pink suffusions around the hair tubercles.

"*Pupa*. The pupa (Plate VII, fig. 8) may be found in the damaged boll enclosed in a light cocoon of silk. It is smaller and less robust than the pupa of *Gelechia*, and is of a different form as will be seen if the illustrations of the two species are compared. The pupa of the pink bollworm is hairy and has several small hooklets near the tip of the abdomen. These are not present on the *Pyroderces* pupa."

Our records have little to add to Mr. Willcocks' description given above. The larvæ sometimes bore into young unopened cotton leaves when they dry up under conditions of rearing. This moth has been reared at Pusa from dry cotton-bolls, cotton buds, *bhindi* (*Hibiscus esculentus*), rotten peach fruit, dry fallen *gular* (*Ficus glomerata*) fruit, rotten bamboo stalk, *tur* (*Cajanus indicus*) stem, dry pods of *Vigna catjang* and from wheat flour in company with *Sitotroga cerealella*; at Coimbatore from cotton bolls and buds, castor, maize cobs and *cholam* (*Andropogon Sorghum*) ear-heads; at Hagari from *cholam* ear-heads webbed up by larvæ of *Stenachroia elongella*; at Gobichettipalayam (Coimbatore District) from a rotten pomegranate fruit; and at Chidambaram, Belgaum, Surat, Shibpore Farm (Calcutta), Ferozepur, Rohtak, Sialkote and Myingyau (Burma) from cotton bolls. From the above records it would appear that this insect is merely a rubbish-feeder on vegetable refuse and not a pest.

ANATRACHYNTIS FALCATELLA, STT.

Gracilaria ? falcatella, Stainton, T. E. S. (n.s.), V, 121 (1859)(1).

Pyroderces spodochtha, Meyr., B. J., XVI, 607 (1905)(2); Exot. Micr., I, 280 (1914)(3).

Anatrachyntis falcatella, Meyr., Exot. Micr., I, 325 (1915)(4); Fletcher, Proc. Second Entl. Meeting, p. 114 (1917)(5).

Reared at Kandy from larva in resinous masses of Lac Coccid, *Tachardia albizziæ*(2). The pupa is described as "unusually stout, entirely without spines; dehiscing by a longitudinal slit in head, not breaking up, antennal cases fixed in pupal skin, abdominal segments apparently all fixed (?), wing-cases firmly attached and reaching to end of seventh segment"(3).

Originally described from Calcutta(1); also recorded from Kandy(2). We have it from Shillong and Pusa. At Pusa it has been reared from larvæ on cotton shoots "in *Eublemma* cage" and "on *Dactylopius* on cotton". The Pusa collection also contains a specimen, identified as *falcatella* by Mr. Meyrick and reared from a rotten pomegranate at Gobichettipalayam (Coimbatore District); but this specimen looks to me like *A. simplex*.

The larva seems to be predaceous on Coccidæ, but has not been described.

ANATARACTIS PLUMIGERA, MEYR.

Anataractis plumigera, Meyr., Exot. Micr., I, 565-566 (May 1916)(1); Fletcher, Entl. Note, 83 (June 1916)(2); Proc. Second Entl. Meeting, p. 81 (1917)(3).

Described from specimens bred at Pusa and Coimbatore from larvæ feeding in stems of *Indigofera*(1).

"*Anataractis plumigera*, Meyr., reared from pupa in stem of Indigo at Pusa, 4 May, 1912 (C. No. 945). The stem was swollen into a gall and evidently the larva had fed inside the stem "(2).

"*Anataractis plumigera* was reared from a gall in a stem of *Indigofera linifolia* at Pusa, but we have not noticed it in any cultivated indigo "(3).

We have this from Pusa and Chapra.

PYRODERCES ALBILINEELLA, VAN DEVENTER.

Pyroderces albilineella, Dev., Tijds. voor Ent., 1904, 33-34, t. 2, f. 5(1); Meyrick, Exot. Micr., I, 310 (1915)(2), *l.c.*, I. 566 (1916)(3).

Originally described from Java(1). Since recorded from the Kei Islands and Ceylon(2).

Bred in April at Coimbatore from larva boring in pods of *Cassia corymbosa*. Pupa rather stout, all segments fixed except anal(3).

It has also been reared at Coimbatore from larvæ in indigo pods and we have it from Virajpet (South Coorg).

PYRODERCES SEMICOCCINEA, STT.

Cosmopteryx ? semicoccinea, Stainton, T. E. S. (n.s.), V. 123 (1859)(1).

Pyroderces semicoccinea, Meyr., B. J., XIX, 411 (1909)(2), Exot. Micr., I, 310 (1915)(3).

Originally described from Calcutta(1); also recorded from Queensland(3).

Reared at Pusa from stems of *Cajanus indicus* in company with *P. promacha*, various Phycitids, etc. It appears to be a rubbish-feeder.

We have this from Pusa, the Shevaroys and Pollibetta (South Coorg).

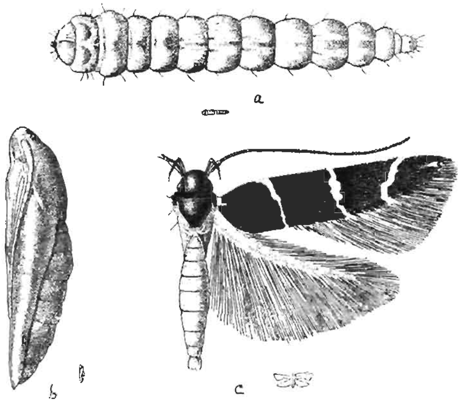
PYRODERCES PROMACHA, MEYR.

Pyroderces promacha, Meyr., Pr. Linn. Soc. N. S. W., 1897, 351(1), Entom. Mitteil. Suppl., III, p. 54 (1914)(2).

Originally described from New South Wales(1), and since recorded from Formosa(2) and India(2). The Pusa collection contains specimens from Pusa, Coimbatore and Peshawar.

It has been reared at Pusa from a *tur* (*Cajanus indicus*) stem and is also said to have been reared from a larva found mining *Phaseolus mungo* leaves at Pusa on 29th April 1907, the moth pupating on 5th May and emerging on 11th May 1907. This larva was described as "2 mm. long, tapering posteriorly, orange-yellow; head yellowish-brown, flattened; thorax flattened; a green median line running from prothorax to anal segment and two brown spots on either side of this median line. When about to pupate it turned red and prepared a cocoon of white threads. Pupa emerged half-way out

PLATE XXII.



Pyroderces callistrepta:—*a*, Larva ; *b*, pupa ; *c*, moth ; natural sizes and magnified.

of cocoon on exit of moth." (A. Mujtaba's Cage-slip 22.) It appears to me doubtful whether the above larva was really that of *P. promacha*. It is possible that the description refers to a Gracillariad leaf-miner, perhaps *Cyphosticha cœrulea*.

PYRODERCES CALLISTREPTA, MEYR. (PLATE XXII.)

Pyroderces callistrepta, Meyr., Exot. Micr., II, 38-39 (1917)(1).

" Bred at Pusa from larvæ mining in leaves of teak (*Tectona grandis*) "(1).

We have this from Pusa and Chapra.

This species mines teak (*Tectona grandis*) leaves at Pusa at the end of February. The larva burrows under the epidermis on the upper surface of the leaf and produces large brown blisters, which are quite prominent on the green leaves and which are also visible from beneath. Several larvæ feed in one leaf and the entire surface of a leaf may show these brown blister-like patches, and practically all the leaves of large trees may be affected. Larvæ were found abundantly on 20th February 1915 and moths emerged between 25th February and 7th April. A large proportion of the larvæ are parasitized by a Chalcidid; from one lot of larvæ collected twelve moths and sixty parasites emerged. If a leaf dries up, the larvæ leave it and are capable of entering fresh leaves and forming new mines therein.

The larva is about 5 mm. long, rather stout, flattened, tapering posteriorly, segments distinct, dirty white; head flattened, narrower than prothorax, shiny brown; prothoracic shield large, shiny brown; legs dark brown; prolegs minute.

Pupation takes place within the larval mine, usually at one side of the mine and alongside a leaf-vein, in a white silken cocoon which is covered with a mass of pellets of frass. The cocoon may easily be located on inspection of the under-surface of the leaf, as the place where it is situated swells up a little and feels hard to the touch. (Pusa Insectary Cage-slip 1161.)

LIMNŒCIA METACYPHA, MEYR.

Limnœcia metacypha, Meyr., Exot. Micr., I, 203-204 (1914)(1).

Described from Peradeniya in October(1). " Cocoon firm, oval, white, with attached excrement, placed between spun leaves where the larva has apparently fed "(1).

LIMNŒCIA PERONODES, MEYR.

Limnœcia peronodes, Meyr., Exot. Micr., I, 318 (1915)(1).

Reared at Pusa in May from larvæ feeding in leaf-sheaths of bamboos(1).

Our specimens are all from Pusa and have been bred from pupa found on bamboo, from larva on unnoted foodplant, and from larva " on Coccidæ

on bamboo (T. N. Jhaveri, 13th July 1908) ". The actual larval food seems uncertain.

COSMOPTERYX MIMETIS, MEYR.

Cosmopteryx mimetis, Meyr., Pr. Linn. Soc. N. S. W., 1897, 339(1), B. J. XIX, 417 (1909)(2), T. E. S., 1910, 372(3), Tr. Linn. Soc. (Z), XIV, 282 (1911)(4), T. E. S., 1915, 205(5).

Common throughout India and Ceylon and widely distributed from Australia(2), New Guinea(2) and Borneo(2) to Mauritius(3, 4), the Seychelles(4) and British Guiana(5).

Mr. Meyrick has suggested that the larva is " probably attached to some plant of cultivation "(3). It may be noted that *Cosmopteryx pallifasciella*, Snell. (*Tijds. v. Ent.*, XL, 138-139, t. 6, f. 1 (1897)), described from Java, mines in sugarcane in its larval stage.

C. mimetis has been bred at Pusa from larvæ found mining leaves of *motha* grass (*Cyperus rotundus*). The larva mines the leaf either in its middle or in its apical part, the mine running along and on either side of the mid-rib. From larvæ collected on 15th September 1916, thirty-eight moths emerged from 25th September to 8th December, and eight Hymenopterous parasites were also reared.

The larva is about 3 mm. long, tapering posteriorly, uniform light yellow ; head flattened, narrower than prothorax, the lobes much elongated posteriorly ; prothorax broader than following segments ; legs and prolegs small. (Pusa Insectary Cage-slips 1472, 1521.)

We have *C. mimetis* from Peshawar, Pusa and Bassein Fort. It is probably widely distributed throughout the Plains of India.

COSMOPTERYX BAMBUSÆ, MEYR. (PLATE XXIII, FIG. 1.)

Cosmopteryx bambusæ, Meyr., Ent. Mo. Mag., LIII, 258 (Nov. 1917)(1).

" Pusa, bred in October from larvæ mining blotches in leaves of bamboo (*Fletcher*). . . . . A pupa-case sent (very little discomposed by the emergence of imago through a small slit) shows only two abdominal segments free, the rest fixed, wing-cases reaching to end of penultimate segment "(1).

Larvæ were found at Pusa on 3rd January 1916 and 21st September 1916, mining blotches in bamboo leaves. The larva mines the leaf, forming a sharply-defined yellowish-white patch in the middle of the leaf-blade and usually on one side of the mid-rib. There may be two or even three larvæ in one leaf, forming mines on either side of the mid-rib or at different places on the same side of it. The mine commences as a narrow strip which gradually

PLATE XXIII.

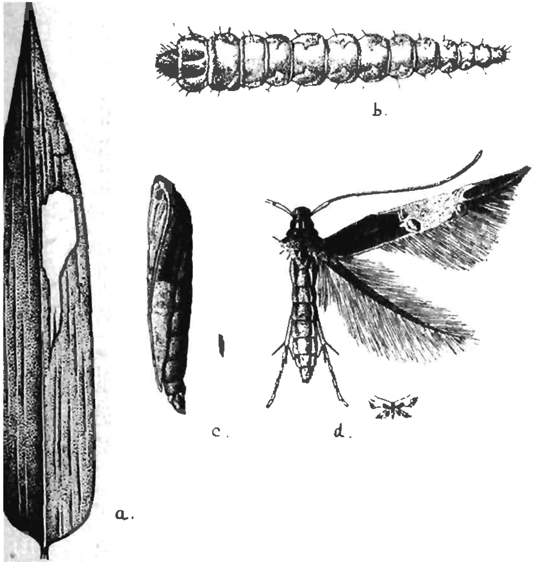


Fig. 1. *Cosmopteryx bambusae*:—*a*. Bamboo leaf with larval mine : *b*. larva ; *c*. pupa ; *d*. moth : (all x 10).

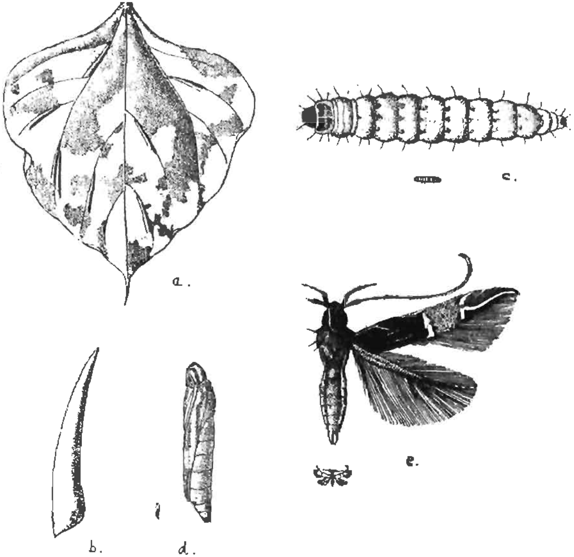


Fig. 2. *Cosmopteryx phaeogastra*:—*a*. Bean-leaf mined by larvæ : *b*. a larval case : *c*. larva : *d*. pupa : *e*. moth : natural sizes and magnified (x 9).

widens and suddenly develops into a large whitish blotch. Wherever the mine may be started, the larva always works towards the apex of the leaf and hence the expanded portion of the mine always lies towards the apex. The narrowed portion of the blotch is filled with brown frass.

The full-grown larva is about 7 mm. long and about 1 mm. across the prothorax and metathorax, which are the broadest segments, tapering posteriorly, flattened, segments well-defined and somewhat protuberant laterally, *uniform pale yellow. Head flattened, much smaller than prothorax (into* which it is partly retractile), brown. Prothoracic shield pale yellow. Spiracles form short minute protuberant tubes. Five pairs of short prolegs.

When full-grown, the larva severs the margins of the broadened portion of its mine and rolls one layer longitudinally inwards and pupates inside the roll so formed.

The larvæ are extensively parasitized, and less than half the number of larvæ collected emerged as moths. Larvæ collected on 21st September 1916 emerged between 11th October and 2nd November 1916, and others collected on 3rd January 1916 emerged between 5th March and 14th April 1916. (Pusa Insectary Cage-slips 1343, 1470.)

COSMOPTERYX PHÆOGASTRA, MEYR. (PLATE XXIII, FIG. 2.)

Cosmopteryx phæogastra, Meyr., Ent. Mo. Mag., LIII, 257-258 (Nov. 1917)(1); Fletcher, Ann. Rept. Impl. Entom., 1917-18, p. 101 (1918)(2).

"Pusa; bred in July from larvæ mining blotches in leaves of bean (*Fletcher*)."

Larvæ were found at Pusa on 22nd November 1916 mining bean leaves, between whose epidermal layers the larva forms a cylindrical silken case which is always placed alongside a leaf-vein. The case is about 10 mm. long, narrowed towards one end and expanded towards the other, and inside it the larva lives, emerging or at least thrusting its anterior extremity out from the broader end of the case and mining the leaf, feeding only at night. The narrower end of the larval case is open and the black larval frass is extruded through it. Usually several larvæ, up to twenty or even more, are found on one leaf, and occasionally two cases are joined together side by side.

The larva is about 6 mm. long and about 1 mm. broad across the middle of the body, rather stout, flattened, tapering slightly anteriorly and more prominently posteriorly, segments distinct, uniform pale yellow; head shiny, dark brown, narrower than prothorax into which it is slightly retractile, lobes prominent posteriorly; prothoracic shield yellow-brown, divided medially; anal segment with a brownish shield; five pairs of small prolegs.

The larvæ hibernated and the moths emerged throughout the month of July 1917. About one-third of the larvæ were parasitized, the parasite emerging at the same time as the moths. (Pusa Insectary Cage-slip 1602.)

We have this from Pusa and from Coimbatore; the latter specimens are labelled "on lablab creeper, 10th February, 1915," but it is not evident whether they were bred or not.

CHOLOTIS CRYPSILOGA, MEYR.

Cholotis crypsiloga, Meyr., Exot. Micr., I, 329-330 (1915)(1).

Reared at Coimbatore in November from larva on *Acacia*(1).

CHOLOTIS PACHNODES, MEYR.

Cholotis pachnodes, Meyr., Exot. Micr., II, 44 (1917)(1).

Bred at Pusa in May from larva feeding on twigs of *Tamarix gallica*(1).

AGANOPTILA PHANARCHA, MEYR.

Aganoptila phanarcha, Meyr., Exot. Micr., I, 334 (1915)(1).

Bred at Pattipola, Ceylon (6,200 feet), in March from galls on undetermined tree(1).

MICROCOLONA CITROPLECTA, MEYR.

Microcolona citroplecta, Meyr., Exot. Micr., II, 49-50 (1917)(1).

Described from Coorg and Pusa. The Pusa specimen, taken in July, was found on a stem of *Eugenia jambolana*, which may perhaps be the food-plant.

BATRACHEDRA ARENOSELLA, WLK.

Gracilaria arenosella, Walker, Cat., XXX, 857 (1864)(1).

Batrachedra arenosella, Meyr., Trans. N. Z. Inst., 1888, 181(2), Pr. Linn. Soc. N. S. W., XXII, 302-303 (1897)(3), Exot. Micr., II, 30-31 (1916)(4).

Batrachedra psilopa, Meyr., B. J., XVII, 982 (1907)(5).

Originally described from New Zealand(1), this widely-distributed species is now known to occur also in Tasmania(3), Queensland(3), New South Wales(3), South Australia(3), and British Guiana(4). Within our limits it has been recorded(4) from Maskeliya, Coorg, Bangalore, Calcutta and the Khasi Hills. We have it from Pusa.

"Larva amongst seeds of *Juncus*, joining them together with a slight web. Pupa very slender, in a cocoon amongst the seeds"(3).

BATRACHEDRA SILVATICA, MEYR

Batrachedra silvatica, Meyr., Exot. Micr., II, 35 (1917)(1).

"Bred at Kumaon (6,000 feet) from twigs of *Pinus longifolia* (*Beeson*). I think the larvæ probably fed on dry refuse, as usual in the genus "(1).

This species was bred in large numbers at Dehra Dun by Mr. C. Beeson in September 1915 from *chir* pine twigs attacked by a *Ripersia* scale, and collected before 20th August 1915 at Almora (6,000 feet). Mr. Beeson considers that this insect is probably predaceous on the *Ripersia*.

The larvæ of *Batrachedra* seem to be feeders on dry refuse. The genus is noteworthy as containing a species (*B. stegodyphobius*) whose larva inhabits the nests of a social spider (*Stegodyphus*) in South Africa.

ŒCOPHORIDÆ.

ENDROSIS LACTEELLA, SCHIFF.

Tinea lacteella, Schiff., Syst. Verz. Schm. Wien, p. 119 (1776)(1).

Endrosis lacteella, Meyr., Handbk., pp. 688-689 (1895)(2), Rec. Ind. Mus., V., 224(3); Wlsm., Fauna Hawaii, p. 649 (1907)(4).

Endrosis fenestrella, Staint., Buckler, Larvæ, IX, 334-335, t. 162, f. 12 (1899)(5).

A cosmopolitan species, recorded from Kurseong(3) and Darjiling(3). We have it from Darjiling and Ootacamund.

The larva feeds on seeds, flour dust and dry refuse generally. Buckler describes the full-grown larva as "about half an inch in length, slender, with reddish-brown head and darker mouth; a plate of similar colour is on the second segment, but divided dorsally by the creamy-white ground colour of the body, and having a margin of this next the head; the anal plate is faintly tinged with yellowish-brown; the segmental folds at the divisions show white" (5). The general colour is whitish or pale flesh-colour.

BORKHAUSENIA PSEUDOSPRETELLA, STT.

Œcophora pseudospretella, Stainton, Syst. Cat. Brit. Tin., p. 14 (1849)(1); Buckler, Larvæ, IX, t. 162, ff. 13, 13*a*, 13*b* (1899)(2).

Acompsia pseudospretella, Meyr., Handbk., p. 637, p. 634, fig. (1895)(3).

Borkhausenia pseudospretella, Meyr., B. J., XX, 143 (1910)(4), Rec. Ind. Mus., V, 224(5).

Recorded from Nuwara Eliya in Ceylon(4), the Khasi Hills(4) and Darjiling(5). Probably originally American, it is now practically cosmopolitan, but probably confined to the Hills within Indian limits. We have it from Ootacamund and the Palni Hills.

The larva is figured by Buckler(?), but without description. Meyrick describes it as "yellowish-white; head red-brown; plate of 2 pale ochreous; on seeds, dried plants, skins, etc."(3).

At Ootacamund a moth was found inside a bee-hive and in the Palni Hills this species has been found breeding on dry hides.

MACROBATHRA NOMÆA, MEYR.

Macrobathra nomæa, Meyr., Exot. Micr., II, 212 (1918)(1).

"Bred [at Coimbatore] from refuse lodged in fork of *Tamarindus indica* (Leguminosæ); no doubt the larva fed on the leaves as usual in the genus, which is wholly confined to the Leguminosæ"(1).

This species has been bred at Coimbatore from refuse found in the fork of a tamarind tree.

TONICA BARROWI, BINGHAM.

Binsitta barrowi, Bingh., T. E. S., 1907, 177-179, t. 13(1).

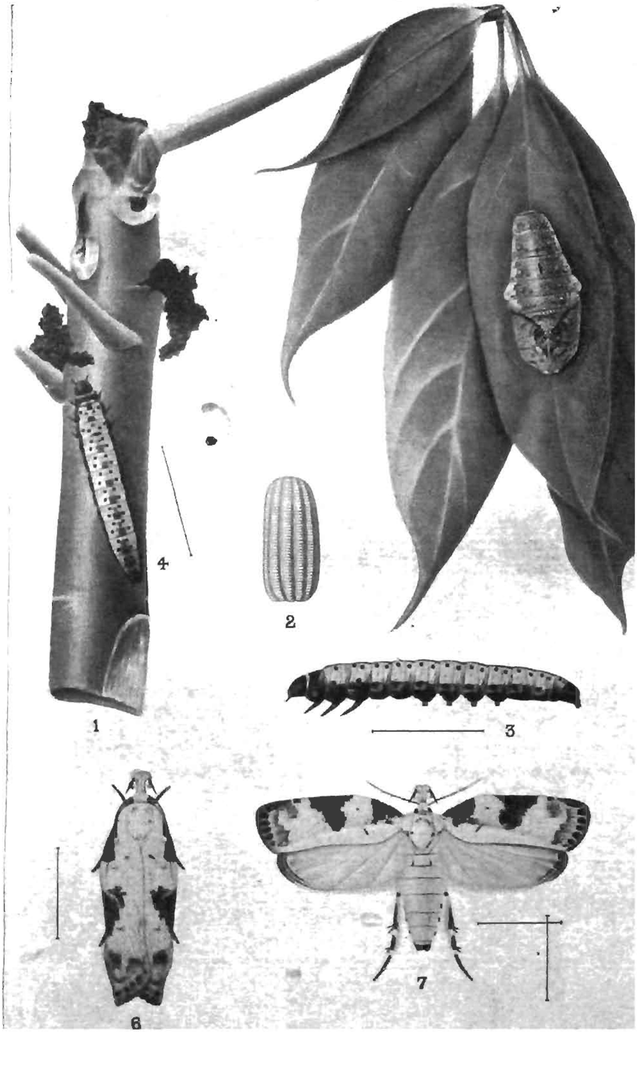
This species was described(1), from Maymyo, in Upper Burma, where the recently-emerged moth was found seated on the empty shell of the pupa which was fixed on to a twig of *Bombax malabaricum*. "In colour the pupa is yellowish-brown, the head is blunt, and with the thorax and wing-cases broad and flattened. On the ventral side the fourth segment has two closely approximate tubercles placed transversely, between which is a longitudinal short white streak; fifth to twelfth segments with transverse rows of small conical projections, constrictions between the segments strongly marked; seventh segment with a large conspicuous rounded black tubercle on each side, behind each of which is a larger pale yellow or white tubercle; on the broad flattened truncated head, dividing the ventral from the dorsal side, is an impressed dark line. The pupa is fixed by its tail end in a semi-erect position to the twig on which it was found, and bears . . . . . . a striking resemblance to the head of a snake and, strange to say, of a bird-eating tree-snake (*Lycodon aulicus*, Linn.) which is far from uncommon in Burma."

TONICA NIVIFERANA, WLK. (PLATE XXIV.)

Binsitta niviferana, Wlk., Cat., XXIX, 832(1); Wlsm., P. Z. S., 1885, 884(2); Lefroy, Ind. Ins. Life, p. 535 (1909)(3).

Tonica niviferana, Meyr., B. J., XX, 167 (1910)(4); Proc. Second Entl. Meeting, p. 131, tab. (1917)(5).

Widely distributed in India and Ceylon. Recorded from Andamans, Solan, Sikkim(4), Calcutta(2, 4), Bombay(4), Karwar(4) and Peradeniya(4).



4
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EXPLANATION OF PLATE XXIV.

TONICA NIVIFERANA.

Fig. 1. Top of a young *Bombax malabaricum* tree showing damage

,, 2. Egg, enlarged.

Figs. 3 & 4. Larva, enlarged.

Fig. 5. Pupa, enlarged.

Figs. 6 & 7. Moth, enlarged.

(The hair-lines show the natural sizes.)

Common at Pusa and Chapra in Bihar. I have also seen a specimen from Nagpur, and we have it from Tocklai (Assam).

The eggs are laid singly and in confinement they were laid on the bottom of the cage and not on the plant supplied. One female laid 57 eggs in confinement. The egg is about 0·75 mm. long and about 0·35 mm. broad, cylindrical, irregularly oval, one end rounded and the other end flattened, the latter with small papillæ all around its rim; the egg-shell has prominent longitudinal ridges, which are toothed transversely throughout their length. (Plate XXIV, fig. 2.)

The complete life-cycle does not appear to have been worked out. Young larvæ, about 6 mm. long, were collected at Pusa on 2nd July 1914, boring into stems of *Bombax malabaricum*. At this stage the colour is uniform brownish-yellow, without any of the markings developed later on in the adult larva; head and large prothoracic shield shining dark brown or black, anal shield dark brown; primary tubercles showing as dull dark brown rounded spots; five pairs of equally-developed prolegs.

The larva bores into the axil of a leaf-sheath. It wanders about a little and selects a place where it means to bore in; then it quickly applies some white silk over this place so as to make a net-like covering under the shelter of which it bores into the plant, and the pellets of frass are attached to this net-work. As they become larger they bore into the stems, eating out the pith and reducing the twigs and branches to hollow tubes which are filled with the black larval extrement.

The full-grown larva is about 25 mm. long and 3·5 mm. broad, cylindrical or slightly sub-cylindrical, the segments clearly defined; head black, shiny, smaller than prothorax which is itself smaller than mesothorax; a broad white band between head and prothorax; prothoracic shield black, shiny, posteriorly yellow; anal segment with its prolegs black, shiny; other segments orange-yellow, dark-grey or black along lower portions of sides and ventral area; primary tubercles showing as circular black spots, from which arise short hairs, the dorsal tubercles connected transversely by dark grey markings; spiracles oval with black shiny rims; five pairs of fully-developed prolegs with crochets arranged in a circle. (Plate XXIV, figs. 3, 4.)

When full-fed the larva emerges from the stem and pupates openly on a leaf, the anal extremity of the pupa being broadly attached by the numerous small curved-tipped cremastral hooks to a net-work of silk applied to the surface of the leaf. The pupa is about 12 mm. long and 6 mm. broad across the thoracic region, roughly tuberculated, brownish-grey. (Plate XXIV, fig. 5.) The pupal period in July is about six or seven days.

When at rest the moth sits with its wings closed over the body and bears a very close resemblance to a bird's dropping. (Plate XXIV, fig. 6.) (Pusa Insectary Cage-slip 727 and unnumbered Cage-slip. dated 2nd July 1914.)

Adult moths have been taken at Pusa in March, April, July, August and October.

TONICA TERASELLA, WLK.

Tonica terasella, Wlk., Cat., XXIX, 788([1]).

Tonica teratella, Meyr., B. J., XX., 167 (1910)([2]).

Originally described from Sarawak([1]), this species has also been recorded from Sikkim([2]) and Karwar([2]). We have it from Sikkim.

Pupa, erect on its tail, exposed ; found on a leaf of bamboo (*Maxwell*)([2]).

TONICA ZIZYPHI, STT. (PLATE XXV, FIG. 1.)

Depressaria zizyphi, Stainton, T. E. S. (n.s.), V, 115-116 (1859)([1]).

Depressaria angusta, Wlsm., in Moore, Lep. Ceylon, III, 508, t. 209, f. 5 (1887)([2]).

Tonica zizyphi, Meyr., B. J., XX, 167 (1910)([3]) ; Fletcher, S. Ind. Ins., p. 459, f. 335 (1914)([4]) ; Proc. Second Entl. Meeting, p. 211 (1919)([5]).

Originally described from Calcutta([1]), where it was bred from *Zizyphus jujuba*([1]). Since recorded from Ceylon([2]), Puttalam, Kegalle and Maskeliya([3]), the Palni Hills([3]) and Coimbatore([4]). Common at Pusa and probably throughout India. It seems to be widely distributed in the Plains and we have it from Coimbatore (larva on orange), Chapra, Pusa (larva on orange, lemon and *Murraya*), and Peshawar (larva on orange).

Larva described as " about 8 mm. long, slender, yellowish-green with a black head. It folds orange leaves longitudinally feeding on young leaves and the green matter of older ones. Pupa 6 mm. long, reddish-brown, in a cocoon of transparent white silk spun in the folded leaf ; pupal period about four to five days "([4]). It feeds on *Citrus* of various species and may sometimes prove a pest by eating back the tender shoots of young plants([4]).

The larva feeds on leaves of *Citrus* spp. and *Murraya kœnigii*. We have not found it on *Zizyphus*. When young the larvæ mine the leaves but after a short time they either tie up several apical leaflets together longitudinally or roll up a single young leaf by turning over the edge on to the blade and feed from within the roll ; young tender leaves are always selected.

The full-grown larva is about 15 mm. long and 1·25 mm. broad, cylindrical, slightly tapering posteriorly, green in colour ; head dull brown ; prothoracic shield large, black ; mesothoracic and metathoracic legs pale greenish-yellow ; primary hairs on segments short, dark brown, placed on tubercles

PLATE XXV

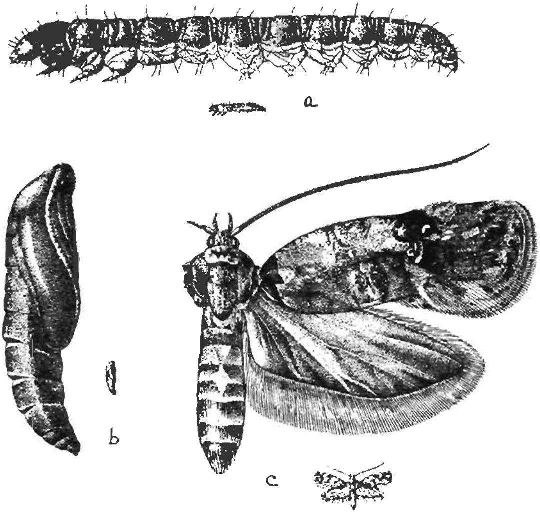
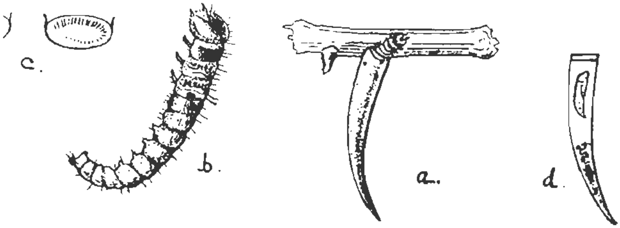


Fig. 1. *Tonica zizyphi*:—*a*. Larva ; *b*, pupa ; *c*. moth ; all natural sizes and magnified.



ig. 2. *Pseudodoxia palimpsesta*:—*a*, Larva in case; *b*, larva removed from case ; *c*, hooks on larval prolegs ; *d*, section of case, showing pupa, cast larval skins and double cover to upper end of case.
All magnified.

which are slightly protuberant above the general surface of the skin; spiracles almost circular, rimmed with black enclosing a clear yellowish space; five pairs of equally-developed short prolegs. Prior to pupation the colour changes to pink or to a dull brown with a slight pinkish tinge.

Pupation takes place in a thin silken cocoon formed inside the rolled-up leaflet or leaflets. The pupa is brown, dorso-ventrally compressed, about 6 or 7 mm. long and about 2 mm. across the metathoracic region, tapering sharply posteriorly; wing-pads rather projecting over ventral surface of body; anal segment with a few longish circinate hairs which are entangled in the cocoon. From larvæ collected on 4th September 1917, fourteen moths emerged between 12th and 23rd September. (Pusa Insectary Cage-slips 789 and 1676.)

CRYPTOLECHIA ARVALIS, MEYR.

Cryptolechia arvalis, Meyr., B. J., XX, 163 (1910)([1]).

Recorded from Karwar in North Kanara and from Coorg([1]).

Larva greyish-green, head black; feeds between two or more leaves of *Careya arborea*, spun together so as to adhere flatly; pupates in same position; abundant in larval stage, but never met with on wing (*Maxwell*)([1]).

PORTHMOLOGA PARACLINA, MEYR.

Porthmologa paraclina, Meyr., Exot. Micr., I, 261 (1914)([1]).

Recorded from Surat([1]) and Pusa([1]). Attached to *Zizyphus jujuba*([1]).

Has been reared at Pusa from larvæ rolling leaves and boring shoots of *ber* (*Zizyphus jujuba*).

PSEUDODOXIA CRETATA, MEYR.

Pseudodoxia cretata, Meyr., B. J., XVII, 407-408 (1906)([1]).

Described from Matale and Peradeniya([1]).

Larva in case exactly like *P. limulus*([1]).

PSEUDODOXIA LIMULUS, ROGENH.

Fumea ? limulus, Rogenhofer, Verh. ZB. Ges., XXXIX, p. 60([1]).

Pseudodoxia limulus, Durrant, E. M. M., 1895, 107-109, figs.([2]); Sharp, Cambr. Nat. Hist., Ins., II, 431 (1899)([3]).

Pseudodoxia sepositella (*nec* Wlk.), Meyr., B. J., XVII, 407 (1906)([4]), *l.c.*, XX, 153 (1910)([5]).

This species is known from Kandy and Pundaluoya([2]).

The larva is of a fleshy-pink colour, the apex of the head black, truncate concave, *forming an operculum to the tube*; *thoracic segments* reddish-pink, first six abdominal segments brownish, the remaining three yellowish. The

larva lives in a case composed of minute fragments of moss, sand and lichens. The anterior end of the case is dilated into a shield-like hood, which hides and protects the head of the larva when feeding. The materials worked into the under-surface of the hood in one specimen are composed entirely of minute fragments of mica. The larva, when disturbed, retires completely into the tube. It feeds upon small mosses and lichens upon rocks and trees. Before pupating, the larva folds down the edges of the hood over the mouth of the tube, like an envelope, fastening them with silk. The case is fixed to the rock or other support, and hangs there until the moth appears (*Green*)(2).

PSEUDODOXIA PALIMPSESTA, MEYR. (PLATE XXV, FIG. 2.)

Pseudodoxia palimpsesta, Meyr., Exot. Micr., I, 308 (1915)(1).

Described from Hazaribagh.

This species was reared from larvæ found feeding on bark of mango twigs at Hazaribagh on 19th May 1911. In the Insectary they were placed on a growing mango plant but were observed to feed very little. They were therefore supplied with bare green twigs on which they were seen to feed a little, nibbling only the epidermis.

The larva was described in May 1911 as about 8 mm. long, cylindrical, tapering posteriorly; head dirty dark brown, with a roughened or somewhat pitted surface, provided with very thin longish hairs, perfectly flattened or truncated in front, the flat surface somewhat depressed in the middle; prothorax entirely covered with a dirty dark brown shield, divided longitudinally in the middle by a faint yellowish line: rest of body soft, pale yellow, posteriorly with a pinkish tinge: segments distinct and wrinkled into transverse folds; the thoracic legs dark brown or blackish, shiny; five pairs of prolegs short, crochets arranged in an incomplete circle and differing in size, crochets on anal prolegs arranged in a line.

The larva lives in a cylindrical horn-shaped case, which is curved on one side, about 16 to 18 mm. long, about 2 mm. broad across the anterior extremity and tapering almost to a point posteriorly, the broad end being truncated and open. The larva protrudes its head and legs through this anterior end of the case and thus hangs to the twigs and feeds. The posterior end of the case is also open but is blocked by the cast larval skins which are packed into this end. The interior of the case is clean and contains nothing but these cast skins, the pellets of frass being thrown out through the open end of the case.

Pupation takes place within the larval case, the open mouth of which s closed by two layers of brown silk. In captivity the case was not attached

to anything for pupation but was lying on the bottom of the dish. The moth emerged by detaching the brown layers from the mouth of the case at one place, leaving the empty pupa-case inside.

On opening one of these cases carefully, fourteen larval skins were found in it, showing that the larva had undergone at least fourteen moults. The mode of moulting is peculiar; the flat part of the head opens like a lid, remaining attached at only one place near the mouthparts and the larval skin is slid off and shoved towards the tapering end of the larval case.

The larval period is apparently prolonged, at least on occasion. From larvæ collected on 19th May 1911, three moths emerged on 24th October 1911, one more moth on 8th October 1912, two larvæ remained feeding on 18th April 1913 and one of these lived until 31st May 1913.

PSEUDODOXIA PICROPHÆA, MEYR.

Pseudodoxia picrophæa, Meyr., B. J., XX, 152-153 (1910)(1).

Described from Hakgala, in Ceylon(1). Larva in portable case on lichens on trees and rocks(1).

PSEUDODOXIA SEPOSITELLA, WLK.

Gelechia sepositella, Wlk., Cat., XXIX, 630(1); Moore, Lep. Ceylon, III. 513 (1887)(2).

Pseudodoxia sepositella, Meyr., B. J., XX, 153 (1910)(3).

Described from Ceylon(1, 2), Maskeliya(3).

Larva in case on lichens.

PROMALACTIS CORNIGERA, MEYR.

Promalactis cornigera, Meyr., Exot. Micr., II, 213 (1918)(1).

"Bred at Almora, 6,000 feet, in August from *Pinus longifolia* (? bark or wood) (*Beeson*)"(1).

This species has also been bred at Dehra Dun by Mr. C. Beeson on 30th March 1916 from a *chir* (*Pinus longifolia*) log collected in the Dalhousie Range, Chamba State, on 26th January 1916.

PROMALACTIS SEMANTRIS, MEYR.

Epicallima semantris, Meyr., B. J., XVII, 408 (1906)(1).

Promalactis semantris, Meyr., B. J., XVIII, 806 (1908)(2).

This species has been bred out at Dehra Dun by Mr. C. Beeson from *sal* (*Shorea robusta*) logs obtained from (1) Guma Range, Goalpara Division, Assam; (2) East Range, Haltugaon Division, Assam; (3) Kheri Division, U. P.;

(4) Lachiwala Range, Siwaliks, and also from a firewood log (of uncertain origin) of *Eugenia jambolana* at Dehra Dun. Emergence took place 3½ to 6 months after the logs had been placed in the breeding cages, ten moths emerging between 15th March and 1st April and one moth on 24th October.

ARISTEIS THWAITESII, MO.

Aprata thwaitesii, Moore, Lep. Ceylon, II, 107, t. 118, ff. 7, 7a (1883)(1); Hampson, Faun. Ind. Moths, I, 304 (1892)(2).

Apparently confined to Ceylon(1, 2). Larva in case on *Eugenia (Syzygium) caryophyllæum*(1).

Mr. Meyrick informs me (*in litt.* 25th Feb. 1916) that this species is perhaps really native in one of the islands further East and carried to the Botanical Gardens at Peradeniya with its foodplant.

PHYSOPTILIDÆ.

PHYSOPTILA SCENICA, MEYR.

Physoptila scenica, Meyr., B. J., XXII, 777 (1914)(1).

Described from Karwar, in North Kanara(1); in Pusa collection from Bababudin Hills, Mysore (November 1912).

Larva in young (but not quite new) shoots of *Careya arborea*; can be detected by excrement protruded in a bunch from the original entrance-hole in stem (*Maxwell*)(1).

XYLORYCTIDÆ.

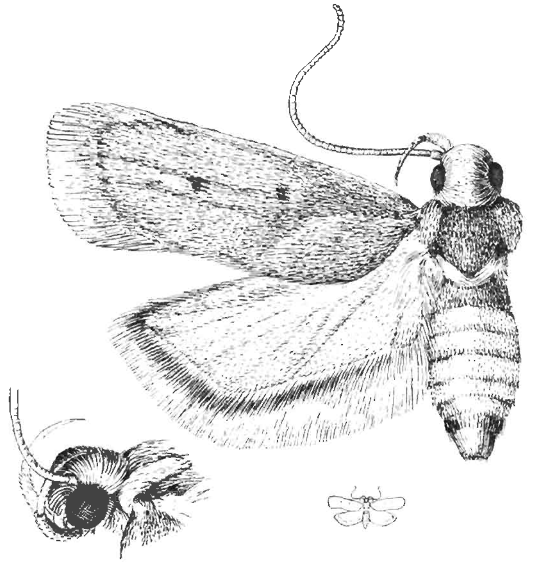
PTOCHORYCTIS SIMBLEUTA, MEYR.

Ptochoryctis simbleuta, Meyr., B. J., XVIII, 150 (1907)(1); Antram, Bark-eating Borers of Tea, pp. 14-16, f. 8 (1907)(2).

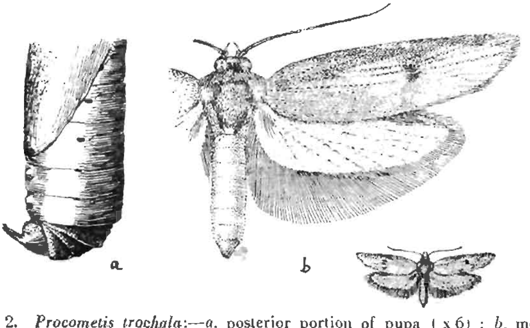
Metathrinca simbleuta, Lefroy, Ind. Ins. Life, p. 535 (1909)(3).

Recorded from several parts of Sylhet, where the larva is a pest on tea-bushes, eating away the bark.

Larva about 12 mm. long, dark red-brown, head black; smooth and hairless. It builds on the bark a raised case made entirely of its own excreta spun together with silk, the upper and lower ends of this case being extended along the branch in the form of a loose web, under which covering the larva feeds, eating right through the bark into the wood of the stem. Pupa in silken cocoon attached to bark under the larval gallery; light brown or yellowish, about 8 mm. long; pupal stage occurs during the latter half of February and March(2).



g. 1. *Odites spoliatrix*:—Moth, natural size and magnified, with more highly enlarged side-view of head.



g. 2. *Procometis trochala*:—*a*, posterior portion of pupa (x 6); *b*, moth, natural size and magnified (x 4).

Mr. Andrews informs me (*in litt.* 7th March 1916) that he does not know this outside of Sylhet.

ANTITHYRA VINEATA, MEYR.

Antithyra vineata, Meyr., B. J., XVII, 404 (1906)(1).

Described from Peradeniya. Larva in a peculiar case on minute algæ and lichens(1).

ODITES ATMOPA, MEYR.

Odites atmopa, Meyr., B. J., XXII, 780 (1914)(1).

Originally described from Kandy(1), this species has been reared at Pusa on 20th March 1913 from larva on *nim* (*Melia azadirachta*) leaves.

ODITES BAMBUSÆ, WLSM.

Odites bambusæ, Wlsm., in Swinh. Cat. Het. Oxf. Mus., II, 544 (1900)(1).

Described from Ootacamund. Larva a leaf-roller on bamboo ; pale green, naked, smooth, rather more than an inch long(1).

ODITES HEDERÆ, WLSM.

Odites hederæ, Wlsm., in Swinh. Cat. Het. Oxf. Mus., II, 544-545 (1900)(1).

Described from Ootacamund. Larva pale green, about an inch long, head brown ; feeds on ivy, sometimes spinning two leaves together flat and living between them, sometimes rolling up the leaves. Pupa brown(1).

ODITES MELITITIS, MEYR. MS.

Has been reared at Coimbatore from pupa in field-beans, 3rd February 1913, and from larva found on a road, 21st July 1913.

ODITES SPOLIATRIX, MEYR. (PLATE XXVI, FIG. 1.)

Odites spoliatrix, Meyr., Exot. Micr., I, 509-510 (1916)(1).

Described from Coimbatore and the Konkan(1).

Bred in August at Coimbatore " from larva forming gallery in nest of a social spider. . . . . . The larva presumably feeds on insect-refuse in the web ; this interesting habit is analogous to that of *Brachmia xerophaga* "(1).

This has also been reared at Pusa, between 1st February and 21st April 1916, from a nest of *Stegodyphus sarasinorum* spun on *Inga dulcis*. One specimen was also reared at Pusa on 28th September 1915 from a collection of larvæ and pupæ found in rolled-up mango leaves, but it is not definitely known that the larva of this moth had fed on mango.

PROCOMETIS TROCHALA, MEYR. (PLATE XXVI, FIG. 2.)

Procometis trochala, Meyr., B. J., XVIII, 635 (1908)(1). P. Z. S., 1908, 730(2); Lefroy, Ind. Ins. Life. p. 536 (1909)(3).

Described from Pusa(1). Also in Pusa collection from Chapra in Bihar.

"Larvæ found feeding upon the dry fallen leaves of sugarcane. The larva fixes two leaves together with silk and lives within, moving gradually along and placing cross threads as it goes, so that its excrement is caught in the threads and the path of the larva can be traced for over a foot between the leaves. It feeds on the dry leaf and pupates between the webbed leaves" (3).

This species has been reared at Pusa from larvæ found webbing together dry sugarcane leaves (trash stripped from the canes) lying on the ground.

A larva found at Pusa on 3rd September 1906 was described as nearly 31 mm. long, broad anteriorly, tapering slightly posteriorly, light dusky grey; head broad, chitinous, dark reddish-grey, with distinct *clypeus*, dull-grey antennæ thickened at scape, and strong, notched, dark-red mandibles; prothoracic shield dark grey faintly speckled with irregular yellowish-brown dots; mesothorax and metathorax with a transverse dark grey line set with small grey hairs; legs dull grey, greasy-looking, acuminate, penultimate segment with shiny chitinous patch; posterior portion of abdominal segments whitish-grey with fine dark grey transverse lines across dorsum, and on these lines fine dull-grey hairs projecting forward; anal segment with a thin dark-grey chitinous shield.

The pupa, obtained from the above larva, was described as 11 mm. in length, cylindrical, tapering posteriorly; head prominent with dark rounded eye-caps; wing-pads deep red; spiracles prominent, small, oval, eight abdominal segments visible.

The larva pupated on 24th September and the moth emerged on 3rd October 1906.

The larva constructs a long tubular gallery of dead leaves lined with silk which may be as long as 13½ inches. It feeds on the epidermal layers and the parenchyma of the leaf. The pupa lives between the folds of the leaves and is never found on the ground.

Besides sugarcane leaves this species has been bred at Pusa from larvæ feeding on dried *arhar* (*Cajanus indicus*) stem and in dead castor branch, and once from a larva found boring into living sugarcane. There are apparently two broods annually, as we have moths taken in June and October.

NEPHANTIS SERINOPA, MEYR.

Nephantis serinopa, Meyr., B. J., XVI, 603 (1905)(¹); Lefroy, Ind. Ins. Life, pp. 535-536 (1909)(²); Fletcher, S. Ind. Ins., pp. 460-461, f. 336 (1914)(³); Proc. Second Entl. Meeting, pp. 259, 262 (1917)(⁴).

Originally described from Batticaloa, on the East coast of Ceylon(¹). Also occurs commonly throughout the Plains of Southern India(²·⁴), Bengal(⁴) and Lower Burma(⁴).

" The eggs, which turn pinkish after deposition, are laid in small batches of a dozen or twenty together amongst the frass and debris of larval galleries on palm leaves. The caterpillar constructs a gallery of silk and excrementitious matter over the lower surface of palm leaves, eating away the green matter and reducing the leaf to a thin membrane so that it dries up and dies. In cases of bad infestation, practically the whole leaf may be eaten away, only the ribs remaining. The caterpillar is about 25 mm. long, in colour greenish with faint paler lines along the body, and a black head. Pupa slender, dark red-brown, in a cocoon spun in the larval gallery. Foodplants :—Coconut and Palmyra palms "(³).

This species does not seem to occur at Pusa and has not been bred there. Our specimens are from Batticaloa (larva on coconut), Koilpatti and Coimbatore (larva on palmyra), Tirumalai, S. Arcot (larva on coconut), Uttarpara (Hughli) (larva on coconut), and Quilon (larva on coconut).

STENOMIDÆ.

SYNCHALARA RHOMBOTA, MEYR.

Agriophara rhombota, Meyr., B. J., XVII, 981-982 (1907)(¹).
Synchalara rhombota, Meyr., Exot. Micr., II, 60 (1917)(²).

Described from the Khasi Hills and Silchar, in Assam(¹).

Larva damaging tea-bushes, feeding between spun leaves and attacking bark when the foliage has been stripped off(¹).

" Very common in Assam and used to be a serious pest. The pupæ are found in large numbers, at this time of year, in the soil at the foot of the bushes, and by systematic collection of these when the bushes are being hand-forked in the cold weather the pest has been completely kept in check in this district [Cinnamara]. It is still very bad in the Margherita district of North Lakhimpur. " (E. A. Andrews, *in litt.* 7th March 1916.)

STENOMA ICHNÆA, MEYR.

Stenoma ichnæa, Meyr., B. J., XXIII, 118 (1914)(¹).

Described from North Kanara(1).

Larva feeding between spun leaves, or a broken portion spun on surface of a whole leaf, of *Symplocos spicata*; pupa very obese, making a constant clicking sound when disturbed (*Maxwell*)(¹).

ORNEODIDÆ.

Twenty-two species of Orneodes and one of *Triscœdecia* are known from the Indian region, but the life-histories of no species have been discovered in India or Ceylon. The only Indian species of whose early stages anything is known is *O. hubneri*, Wlgn., which is widely distributed in Europe, South Africa and Canada and which has been recorded from Kashmir also. The larva of *O. hubneri*, according to Hofmann (*Iris*. XI, 350-351 (1898)), feeds in Europe in the flowers and seeds of *Centaurea jacea* and *Scabiosa* (*Knautia*) *arvensis*, forsaking the *Scabiosa* flowers when full-fed and pupating in little cocoons made of petals of the dried flowers. In India the larvæ may be looked for in flowers, and perhaps also in galls in stems, of *Lonicera*, *Scabiosa*, *Stachys* and *Colquhounia coccinea*.

COPROMORPHIDÆ.

Four species have been described from Ceylon and Assam. The early stages of no Indian species are known as yet.

November 1920. ENTOMOLOGICAL SERIES VOL. VI, No. 5.

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA

V. HELIOZELIDÆ, HELIODINIDÆ GLYPHIPTERYGIDÆ BLASTOBASIDÆ AND HYPONOMEUTIDÆ

BY

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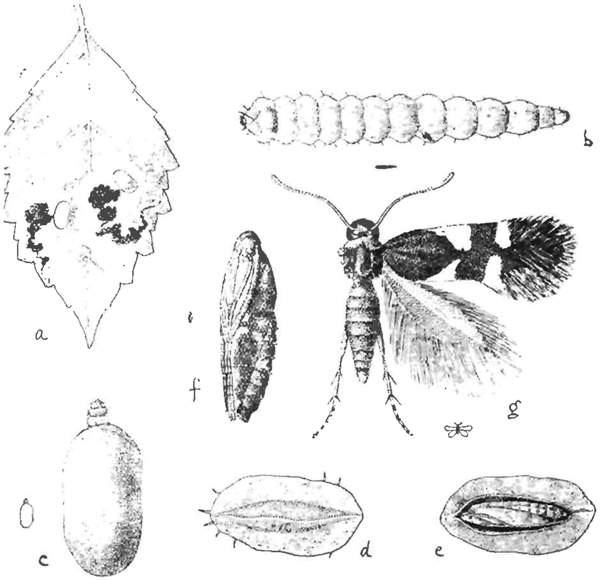
PLATE XXVII.



pila argostoma:—

a, mined leaf of *Vitis trifolia* showing two larval galleries, on right side a portion of leaf cut ready to make cocoon, on left side a portion cut and removed;

b, Larva (x 16) ;

c, Larva in leaf-case ready to make cocoon ;

d, completed cocoon ;

e, Cocoon opened, showing pupa ;

f, Pupa.

g, Moth. All magnified (x 16).

LIFE-HISTORIES OF INDIAN INSECTS. MICROLEPIDOPTERA.

V. HELIOZELIDÆ, HELIODINIDÆ, GLYPHIPTERYGIDÆ, BLASTOBASIDÆ AND HYPONOMEUTIDÆ.

BY

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HELIOZELIDÆ.

ANTISPILA ARGOSTOMA, MEYR. (PLATE XXVII.)

Antispila argostoma, Meyr., Exot. Micr., II, 8 (Oct. 1916)(1).

Bred at Pusa "in August from larva mining blotch in leaf of *Vitis trifolia* (*Fletcher*); cocoon sent is oval, similar in construction to preceding [*aristarcha*] but larger, greyish-ochreous, spinous filaments only 1-14 length of cocoon "(1).

This species is common at Pusa during the Rains (July-September), and has been bred from larvæ mining leaves of *Vitis trifolia.* Although it may be reared in numbers, the adult insect has never been noticed under natural conditions. The larva mines a portion of the leaf, leaving intact the two membranous epidermal layers. It commences the mine from any place on the surface. While the larva is young it causes a narrow zigzag yellowish-white line as it mines on and in the middle of this line a streak of black excrement is left along its whole length. The mine becomes gradually broader and then develops rather abruptly into a large yellowish-white blotch and the quantity of excrement is also large, appearing like a large black patch in the middle of the mine. When the larva is full-grown, it lines an oval portion of the mine near the edge with brown silk and converts it into a flat

roughly oval case which is then cut off entirely from the leaf, leaving an oval hole in its place. The case is composed of two thin slightly concave pieces joined together on their concave faces. The margins are loosely fastened with silk. After cutting out this case, the larva behaves exactly like a case-bearer such as *Macraeola inquisitrix* and moves about, carrying the case and thrusting its head out at either end indifferently. As the larva is devoid of legs, it effects locomotion in a peculiar way by means of silk; the head is thrust out of the case and silk is applied to the surface on which it moves, thus securing the case; next, silk is stretched from the margin of the case to some point ahead and the case is drawn forward and fastened there; thus the larva moves about in its case even on vertical surfaces. After some time the case is fastened to a suitable place, usually by two or more silken threads of which one end is attached to the margin of the case and the other to the supporting surface. In confinement the cases were attached to the leaves lying on the bottom of the cage, or to the walls or top of the cage. After securing the case to a suitable place, the larva spins a brown oval cocoon inside it and pupates in that. The cocoon is formed in the central part of the case, its longer axis lengthwise. When the cocoon is formed, the central portions of the two leaf epiderms forming the case are drawn much closer together, with the result that a longitudinal ridge appears at the middle of each.

In some of these cases, there are a few short brown processes radiating from the margin (figure *d*); these are strands of silk which are applied to the margins of the case to connect it to the leaf while it is being cut out by the larva.

The full-grown larva (figure *b*) is about 4 mm. long by about 0·75 mm. broad across middle, flattened, tapering posteriorly, segments distinct and rather protuberant laterally, pale yellow with a greenish tinge, somewhat shiny and transparent; head smaller than prothorax, red-brown; prothorax wholly dark brown; thin hairs scattered on head and body; legs and prolegs absent.

The pupa (figure *f*) is about 2·25 to 2·5 mm. long, dorsally rather convex, narrowed towards extremities, brown (darkening before emergence of adult); a deep constriction behind head, differentiating this from thorax; tip of wing case reaching penultimate segment and posterior legs reaching or even slightly exceeding anal extremity; four abdominal spiracles on each side are white tubular projections. Before emergence of the moth, the pupa wriggles out to some extent through one end of the cocoon, the empty pupa-case remaining protruding from the cocoon. The pupal period is about six days. (Pusa Insectary Cage-slips 1431, 1463.)

ANTISPILA ARISTARCHA, MEYR.

Antispila aristarcha, Meyr., Exot. Micr., II, 8 (Oct. 1916)(1).

Bred at Karwar, North Kanara, " in August from larvæ mining transparent blotches in leaf of *Vitis* sp. (many larvæ in a leaf) (*Maxwell*). Cocoons sent by Mr. Maxwell are apparently formed of two rather irregular grey discs of leaf-cuticle joined at the edges, with several projecting spinous filaments at each end, which are probably natural projections of the leaf, about $\frac{1}{8}$ length of cocoon "(1).

HELIODINIDÆ.

STATHMOPODA HEMITORNA, MEYR.

Stathmopoda hemitorna, Meyr., Exot. Micr., I, 97 (1913)(1) ; *l.c.*, II, 62 (1917)(2).

Originally described from Siruguppa (Bellary), this species has since been recorded from Dharwar and bred at Coimbatore " from refuse collected in fork of tamarind (*Tamarindus indica*) (Fletcher) ; probably therefore the larva feeds in the pods "(2). It seems more probable that the larvæ were feeding on the dead leaves collected in the fork of the tree.

STATHMOPODA THEORIS, MEYR.

Æoloscelis theoris, Meyr., B. J., XVII, 410-411 (1906)(1).

Stathmopoda theoris, Meyr., *t. c.* p. 983(2), T. L. S. (2) XIV, 286 (1911)(3), Entom. Mitteil. Suppl., III, p. 56 (1914)(4) ; Lefroy, Ind. Ins. Life, p. 537 (1909)(5) ; Imms and Chatterjee, Ind. For. Mem., III, 32, t. 7, f. 23 (1915)(6) ; Proc. Second Entl. Meeting, p. 96 (1917)(7).

Common throughout India and Ceylon(1) ; also recorded from Formosa(4).

Larva feeds in flower-heads of sunflower (*Helianthus*)(3,6).

Larva slender, black, naked, with five pairs of prolegs, head and prothoracic shield black ; found feeding in sunflower heads, the seeds apparently not eaten, but the dried remains of the flowers(5).

" We have reared . . . . . *Strathmopoda theoris*, Meyr., from lac received from Bhandara and Jubbulpore . . . . . we have not reared a sufficient number of examples to definitely prove that it is an undoubted enemy of lac, and not merely only accidentally associated with it "(6).

This species has been reared at Coimbatore on *cholam* ear-heads, from refuse found in the fork of a tamarind tree, and from palm-fibre chewed by *Oryctes rhinoceros* ; and at Pusa from sunflower heads, from a rotten peach-fruit, from ripe fallen *gular* (*Ficus glomerata*) fruit, from drying balsam leaves, from dry cotton and *Acacia arabica* leaves, and from cotton shoots badly affected by a mealy-bug. We have it also from Surat and from Dinanagar (Punjab).

The larva seems to be a feeder on dead vegetable matter, spinning together dead or drying leaves and nibbling irregular holes in them.

STATHMOPODA SYCOPHAGA, MEYR.

Stathmopoda sycophaga, Meyr., Exot. Micr., I, 87-88 (1913)(1).

Reared at Pusa in May from larvæ in figs of *Ficus glomerata*(1).

Larvæ were found at Pusa on 14th April 1907 in figs of *Ficus glomerata* and were described as about 15 mm. long, cylindrical, slightly tapering towards either extremity ; head and prothoracic shield brown, shiny ; body-segments distinct, pale yellow, segments with a brownish tinge and with small scattered hairs ; five pairs of prolegs. *The larva bores into the figs and eats the florets. Pupation takes place inside the fig in a white cocoon* in which the pupa-case remains on the emergence of the moth. The larvæ are parasitized by two Dipterous and three small Hymenopterous flies. The moths from these larvæ emerged between 29th April and 11th May 1907. (Pusa Insectary Cage-slip 529.)

STATHMOPODA BASIPLECTRA, MEYR.

Stathmopoda basiplectra, Meyr., Exot. Micr., I, 97 (1913)(1) ; Imms and Chatterjee, Ind. For. Mem. (Zool.), III, 32-33 (1915)(2).

Described from Ranipur, in the Hardwar District, where it was bred in April from " larva burrowing in seeds of *Albizzia lebbek* (Leguminosæ) in December, afterwards eating a hole through the wall of pod to emerge "(1).

" We have reared . . . . . *S. basiplectra*, Meyr., from lac obtained from Ranipur in the Siwalik forests . . . . . There seems to be little doubt that its larva devours the lac, but it does not appear in sufficient abundance to warrant its being regarded as a serious enemy. We have bred out the insect from April to July and there is a specimen in the Forest Research Institute Collection that was obtained in November and bred out from lac by Mr. V. S. Iyer "(2).

STATHMOPODA PRÆALBATA, MEYR.

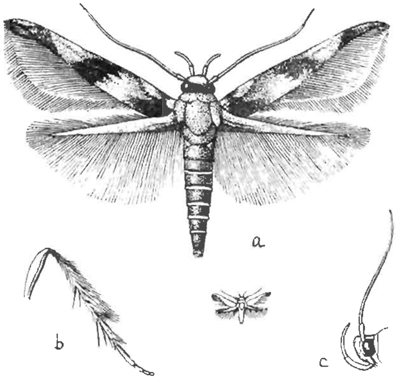
Stathmopoda præalbata, Meyr., Exot. Micr., I, 337 (1915)(1).

This species has been bred at Pusa in February-March 1916 from fallen banyan (*Ficus bengalensis*) fruits collected in November 1915. We also have it from Chapra.

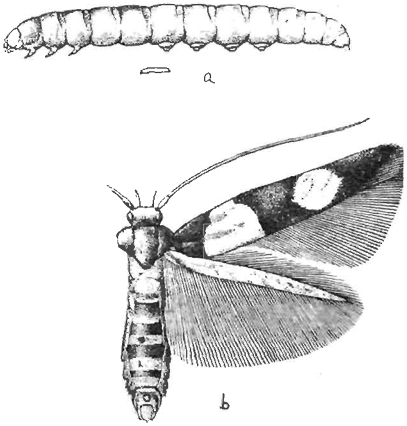
STATHMOPODA SYCASTIS, MEYR. (PLATE XXVIII, FIG. 1.)

Stathmopoda sycastis, Meyr., Exot. Micr., II, 62 (1917)(1) ; Proc. Second Entl. Meeting, p. 251 (1917)(2).

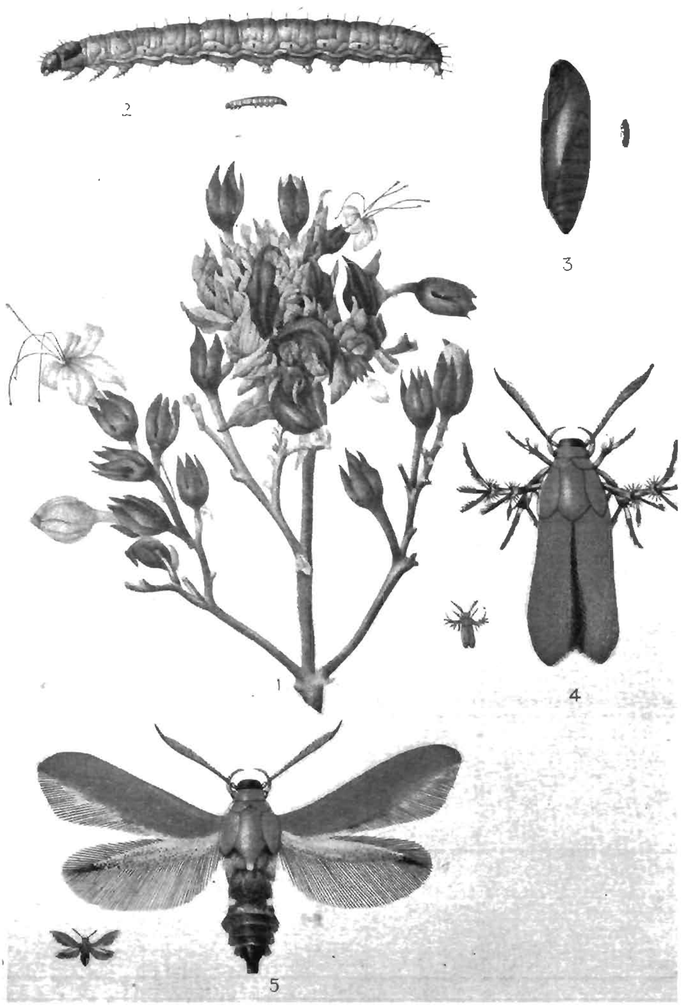
Bred in July at Tarnab, Peshawar District, from larva feeding in figs of *Ficus carica* (*Fletcher*)(1, 2).



1. *Stathmopoda sycastis*:—*a*, Moth, natural size and magnified : *b*, hind leg of moth, magnified ; *c*, side-view of head of moth, magnified.



g. 2. *Stathmopoda ovigera*:—*a*, Larva, natural size and magnified (x 12) ; from a spirit specimen ; *b*, moth, magnified (x 12).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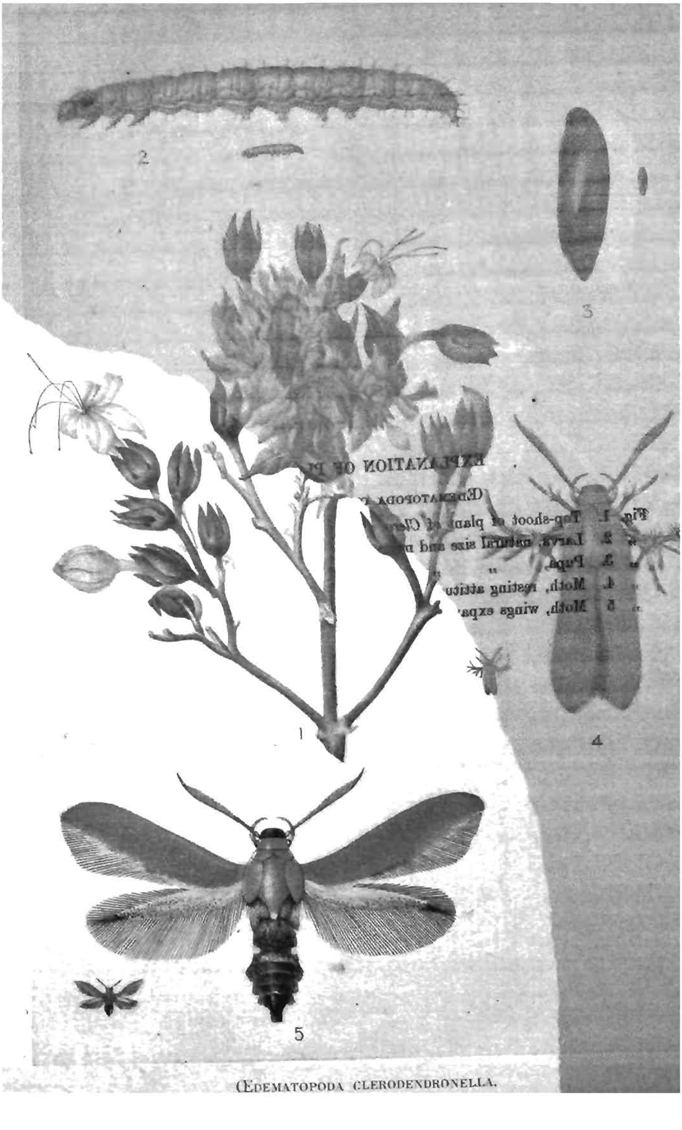
EXPLANATION OF PLATE XXIX.

ŒDEMATOPODA CLERODENDRONELLA.

Fig. 1. Top-shoot of plant of *Clerodendron infortunatum* spun up by larva.
„ 2. Larva, natural size and magnified.
„ 3. Pupa, „ „ „
„ 4. Moth, resting attitude, from above, natural size and magnified.
„ 5 Moth, wings expanded, natural size and magnified.



ŒDEMATOPODA CLERODENDRONELLA.

A larva was found boring in a ripe fig on 3rd June 1916. It pupated before 14th June in a white silken cocoon spun in a corner of the box and the moth emerged at Pusa on 19th July.

This caterpillar is well-known in the Peshawar District, so much so that the local people are rather chary of eating figs on account of the caterpillars in them.

STATHMOPODA OVIGERA, MEYR. (PLATE XXVIII, FIG. 2.)

Stathmopoda ovigera, Meyr., Exot. Micr., I, 93 (1913)(1).

This species was originally described from Puttalam (Ceylon)(1). It has since been bred from blackish larvæ found in fluffy masses of *Pulvinaria* sp. on *Ficus glomerata* at Coimbatore in December 1916. We have moths from Peshawar also, so that it is evidently widely distributed in the Plains of India and Ceylon.

STATHMOPODA ADULATRIX, MEYR.

Stathmopoda adulatrix, Meyr., Exot. Micr., II, 61 (1917)(1).

Bred in September in Almora (6,000 feet) from twigs of *Pinus longifolia* (*Beeson*)(1).

ŒDEMATOPODA VENUSTA, MEYR.

Œdematopoda venusta, Meyr., Exot. Micr., I, 97 (1913)(1).

Described from Jabalpur in the Central Provinces, where it was bred from colonies of *Tachardia lacca*(1).

ŒDEMATOPODA CYPRIS, MEYR.

Œdematopoda cypris, Meyr., B. J., XVI, 603 (1905)(1).

Reared in December at Kandy from colony of Lac Coccid, *Tachardia albizziæ*, on *Theobroma cacao*.

ŒDEMATOPODA FLAMMIFERA, MEYR.

Œdematopoda flammifera, Meyr., Exot. Micr., I, 338 (1915)(1).

Described from Pusa(1), where it was reared in June 1907 from a larva in a mango shoot. This is the only specimen known so far.

ŒDEMATOPODA CLERODENDRONELLA, STT. (PLATE XXIX.)

Atkinsonia clerodendronella, Staint., T. E. S. (n.s.), V, 125 (1859)(1).

Œdematopoda clerodendronella, Wlsm., T. E. S., 1889, t. 6, f. 7(2); Lefroy, Ind. Ins. Life, p. 537 (1909)(3).

Originally described from Calcutta(1). Found commonly at Pusa and Chapra in Bihar.

Larva brownish, with a few short hairs; it webs up the top of a shoot and pupates in a thin silk cocoon in the bunch of leaves, the moth emerging inside the cocoon. Feeds on *Clerodendron infortunatum* and *Anisomeles ovata*(3).

The larva is about 10 mm. long. It folds up a leaf or webs up the tender top-leaves by means of white silken threads, living in shelter and eating holes in the leaves from within. Pupation takes place in the folded leaves or amongst the flower-heads, when these are available.

The adults occur at Pusa in March, June and July-August.

ERETMOCERA IMPACTELLA, WLK. (PLATE XXX.)

Gelechia ? *impactella*, Wlk., Cat., XXIX, 637(1).

Eretmocera impactella, Moore, Lep. Ceylon, III, 514, t. 209, f. 10 (1887)(2), Wlsm., T. E. S., 1889, pp. 34-35, 39, t. 6, f. 18(3); Hmpsn., Faun. Ind., Moths, I, 208, f. 135(4); Lefroy, Ind. Ins. Life, p. 537 (1909)(5); Fletcher, S. Ind. Ins., p. 461, f. 337 (1914)(6); Proc. Second. Entl. Meeting, p. 296 (1917)(7).

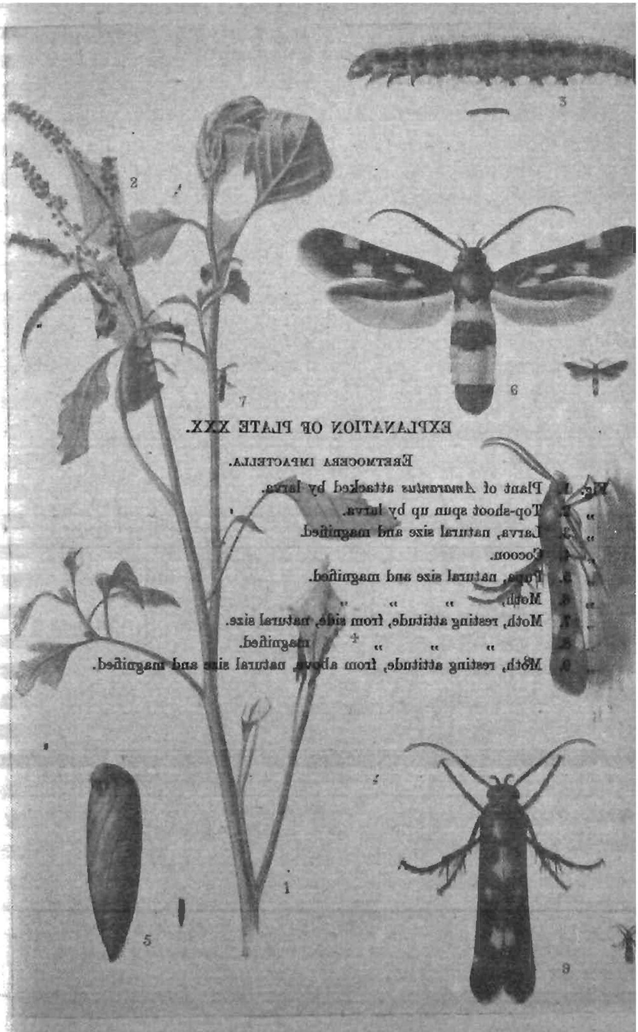
Common throughout the Plains of India, Burma and Ceylon. Also recorded from Singapore and Formosa.

The larva feeds on *Amarantus*(6, 7) and is sometimes a minor pest, webbing up the heads of the plants. It remains more or less hidden in the folds of the leaves which are spun together with white silken threads. It walks very fast and, when walking, a small hump is produced at the hind end of the body. When disturbed it is able to make small springs.

The larva is about 10 mm. long, moderately stout, cylindrical, tapering slightly towards either extremity, brownish-grey or brownish-yellow with a broad submedian darkish stripe; head bilobed, with an inverted Y-shaped mark in front, posterior external part of each lobe black, rest of head speckled with black, with long white hairs; prothoracic shield dark, broadly divided medially; tubercles black, bearing several divergent longish white hairs, which give the larva rather a hairy appearance; prolegs fully developed with crochets arranged in a circle.

Pupation takes place in a cocoon of white silk, very fine and cottony, the cocoon being spun usually amongst the leaves. The larva rests for about a day inside this cocoon and then casts off the last larval skin which remains attached to the pupa, enclosing its anal segments.

The pupa is about 6 mm. long, uniform brown, and tapers prominently posteriorly; wings and legs folded ventrally, their tip about reaching the eighth abdominal segment. There seem to be no cremastral hooks on the



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Eretmocera impactella, Moore, Lep. Ceylon, III, 514, t. 209, f. 10 (1887)(2), Wlsm., T. E. S., 1889, pp. 34-35, 39, t. 6, f. 13(3); Hmpsn., Faun. Ind., Moths, I, 208, f. 135(4); Lefroy, Ind. Ins. Life, p. 537 (1909)(5); Fletcher, S. Ind. Ins., p. 461, f. [illegible] Entl. Meeting, p. 296

EXPLANATION OF PLATE XXX.

ERETMOCERA IMPACTELLA.

Fig. 1. Plant of *Amarantus* attacked by larva.
„ 2. Top-shoot spun up by larva.
„ 3. Larva, natural size and magnified.
„ 4. Cocoon.
„ 5. Pupa, natural size and magnified.
„ 6. Moth, „ „ „
„ 7. Moth, resting attitude, from side, natural size.
„ 8. „ „ „ magnified.
„ 9. Moth, resting attitude, from above, natural size and magnified.

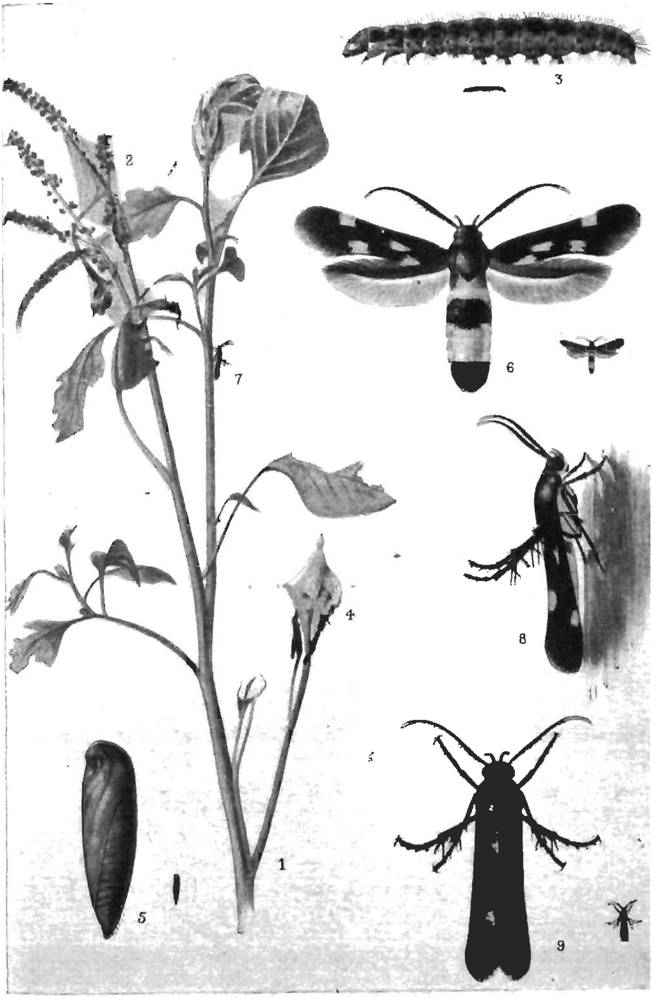
[illegible] of India, Burma and Ceylon. Also record[illegible]

The [illegible] on *Amarantus*(6, 7) and is sometimes a minor pest, webbing up the h[illegible] or less hidden in the folds of the leaves, which are spun together with white silken threads. It walks very fast and, [illegible] hind end of the body. When disturbed it is able to make small springs.

The larva is about 10 mm. long, moderately stout, cylindrical, tapering slightly towards either extremity, brownish-grey or brownish-yellow with a broad submedian darkish stripe; head bilobed, with an inverted Y-shaped mark in front, posterior external part of each lobe black, rest of head speckled with black, with long white hairs; prothoracic shield dark, broadly divided medially; tubercles black, bearing several divergent longish white hairs, which give the larva rather a hairy appearance; prolegs fully developed with crochets arranged in a circle.

Pupation takes place in a cocoon of white silk, very fine and cottony, the cocoon being spun usually amongst the leaves. The larva rests for about a day inside this cocoon and then casts off the last larval skin which remains attached to the pupa, enclosing its anal segments.

The pupa is about 6 mm. long, uniform brown, and tapers prominently posteriorly; wings and legs folded ventrally, their tip about reaching the eighth abdominal segment. There seem to be no cremastral hooks on the



Eretmocera impactella

anal segment, but all over the body and head there are scattered small stiff hairs with curved tips which are hooked into the fibres of the cocoon. On emergence of the moth, the empty pupa-case is left within the cocoon. (Pusa Insectary Cage-slip 702.)

The life-cycle is between three and four weeks. A fertilized female confined with living *Amarantus* plants on 30th May 1911 died on 2nd June, after laying eggs which were not observed. Two young larvæ were found on 8th June and of these one spun up on 17th June and the moth emerged on 27th June 1911.

We have this from Coimbatore, Mangalore, Sidapur, Tranquebar, Surat, Nadiad, Bassein Fort, Multan, Peshawar, Abbottabad, Pusa, and Upper and Lower Burma. The moth varies considerably in markings, the yellow spots on the forewing being sometimes obsolescent and both wings suffused with blackish.

GLYPHIPTERYGIDÆ.

HILAROGRAPHA CAMINODES, MEYR.

Hilarographa caminodes, Meyr., B. J., XVI, 610 (1905)(1); Green, Peradeniya Circ., II, 17, p. 250 [not named](2); Fletcher, S. Ind. Ins., p. 464 (1914)(3); Proc. Second Entl. Meeting, p. 37 (1917)(4).

Described from Ceylon (Pundaluoya, Gammaduwa and Rangella); larva a pest on cardamom(1). We have it from Gammaduwa.

Larva bores in the root of cultivated cardamoms and in wild Zingiberaceous plants. The eggs are laid on the exposed upper part of the bulb(2 3).

IMMA MYLIAS, MEYR.

Imma mylias, Meyr., T. E. S., 1906, 173 (1906)(1); Exot. Micr., II, 191 (1918)(2).

Originally described from Ceylon(1), this species has been found at Coimbatore also.

An example received from Mr. Fletcher, said to have been "bred from tamarind bark." Pupa with four segments fixed(2).

PHYCODES MINOR, MO.

Phycodes minor, Moore, P. Z. S., 1881, 378(1), Lep. Atk., ii, 152 (1882)(2); Cotes & Swinhoe, Cat. Moths Ind., p. 701 (1889(3); Meyr., Rec. Ind. Mus., V, 226(4); Proc. Second Entl. Meeting, p. 251(5).

Phycodes lucasseni, Snell., Tijds. voor Ent., XLIV, 74, t. 5, f. 1 (1901)(6).

Phycodes cymineuta, Meyr., B. J., XIX, 424-425 (1909)(7).

Recorded from N. W. India([2]), Kulu([3]), Bengal (Rajmahal)([4]) and Karagola([2]), from Haputale in Ceylon([5]), and from Java([6]). Common at Pusa in Bihar and apparently throughout the Plains of India. We have it from Peshawar, Hazara, Lahore, Poona, Pusa, Gauhati, Nowgong, and Minbu (Lower Burma).

Larva on *Ficus* spp. The moth has been reared at Lahore from pupa found in leaf of *Ficus carica* and at Pusa from larvæ rolling leaves of *Ficus heterophylla*.

The larva is about 15 mm. long and 2 mm. broad across the metathoracic region, whence it tapers slightly in both directions, cylindrical, segments fairly distinct, light green; head flattened, yellow, shiny, with a black lateral longitudinal marking: prothorax with a more or less shiny shield, a portion between head and shield greenish-white; mesothorax and metathorax dark smoke-colour, this colour extending in a less dark form on the ventral side; legs black: abdominal segments with dark smoky submedian patches forming an interrupted stripe, and with a similar less distinct spiracular stripe, white patches alternating with the smoky ones; a white lateral stripe; primary hairs white; spiracles small, black, round; five pairs of equally developed prolegs which appear like slender rod-like protuberances from the abdominal folds, crochets on prolegs arranged in a circle.

Pupation takes place in a white silken cocoon formed amongst rolled leaves or on a single leaf which is rolled into a boat-shape. A large quantity of silk is used to make the cocoon which consists of several layers of thin papery structure. Pupa brown, cylindrical, tapering posteriorly, and with a row of small posteriorly-directed spines on the anterior part of the dorsal surface of the abdominal segments. Before emergence of the moth, the pupa wriggles out through one end of the cocoon to some extent. A Tachinid parasite has been reared. From larvæ collected at Pusa on 25th September the moths emerged between 8th and 12th October 1917. (Pusa Insectary Cage-slip 1711.)

PHYCODES RADIATA, OCHS.

Chimæra radiata, Ochs., Schmett. Europ., II, 5-6 (1808)([1]).

Phycodes hirudinicornis, Guenee, Noct., II, 389, 1249, t. 13, f. 5 (1852)([2]).

Tegna hyblæella, Wlk., Cat., XXXV, 1810 (1866)([3]); Forsayeth, T. E. S., 1884, 379, 413, t. 14, f. 10([4]).

Phycodes radiata, Lefroy, Ind. Ins. Life, p. 538, t. 52, ff. 7-10 (1909)([5]); Fletcher, S. Ind. Ins., pp. 463-464, f. 339 (1914)([6]); Proc. Second Entl. Meeting, p. 251 (1917)([7]).

Common throughout India (from Nepal and Dharmsala to Bombay and Madras) and Ceylon. We have it from Coimbatore (larva on *Ficus*), Hagari (larva on leaves of *Ficus tisela*), Pusa (larva on leaves of *Ficus religiosa* and *F. glomerata*), Kulu, Gurdaspur, Garhshankar (Punjab) (larva on *Ficus carica*) and from Peshawar (larva on *Ficus carica*).

Larva about 20 mm. long, moderately stout, rather flattened, smooth; with scattered short hairs, in colour dull yellowish-white with a broad interrupted dark stripe along the side, head and prothoracic shield red-brown, a broad dark band transversely across the back of meso- and meta-thoracic segments. The caterpillar rolls leaves of *Ficus*. Pupa red-brown, in a tough paper-like cocoon, occasionally spun on a leaf but more usually in a crack of the bark or similar situation; pupal period about 15 days(6).

The egg has not been observed but is probably laid on tender fig leaves. The larvæ roll tender leaves, either folding over the edge of a leaf or tying one leaf over another, and eat the epidermis from within the roll.

A young larva, about 10 mm. long, is rather flattened; head flattened, yellow-brown, smaller than prothorax; prothorax smaller than mesothorax, wholly dirty dark-brown or blackish, with a shiny black shield; mesothorax slightly smaller than metathorax, dirty dark-brown, anteriorly banded with yellow; abdominal segments yellow; legs black; five pairs of prolegs yellow.

The full-grown larva is about 22 mm. long, rather flattened; head shiny yellow-brown, flattened, smaller than prothorax; prothoracic shield large, shiny, dark brown; prothorax laterally whitish, ventrally blackish; mesothorax and metathorax blackish dorsally, laterally and ventrally whitish; a whitish band between mesothorax and metathorax; first abdominal segment yellowish with a faint black marking on lateral margin of submedian region; remaining segments greyish-white; submedian portions of second to sixth abdominal segments black; upper part of seventh abdominal segment black and of eighth abdominal segment yellow with a pair of black points; ninth abdominal segment yellowish anteriorly and blackish posteriorly; a few long white hairs on each segment; spiracles oval, rimmed with black.

Pupation takes place within a flattened, oval, disc-shaped, dirty brown cocoon of rather papery texture, about 15 mm. long and 7 mm. broad. In warm weather the cocoon may be formed within folded leaves but in winter it is always formed on the trunk of the tree. Before emergence of the moth, the pupa wriggles out of the cocoon for about half its length.

The moth is diurnal in habit and may be seen sucking nectar from flowers during the daytime.

The larvæ occur at Pusa from April to November. Hibernation apparently takes place in the pupal, and possibly also in the larval, state. From cocoons collected during the winter moths emerged in March-May. (Pusa Insectary Cage-slip 255.)

SIMAETHIS OPHIOSEMA, LOWER.

Simaethis ophiosema, Low., Trans. Royal Soc. S. Austral., XX, 167 (1896)(1); Meyr., Cat. Glyphipt., p. 35 (1913)(2).

? *Simaethis regularis*, Pag., Jahrb. Nass. Verb. Naturk., XXXVII, 288 (1884)(3).

Originally described from Australia(1), *S. ophiosema* has also been recorded from China(2), the Moluccas(2) and India(3).

This species has been bred at Pusa from a larva found on 6th October 1912, letting itself down by a silken thread from a bamboo overhanging the road. The larva was about 13 mm. long, cylindrical, tapering slightly towards either extremity, head brown, body uniformly light yellow spotted with black like the larva of *Antigastra catalaunalis*. The larva formed an elongated white cocoon of white silk lining a folded bamboo leaf on 7th October, pupated on 8th and emerged on 13th October. (Pusa Insectary Cage-slip 968.)

We have this insect from Srinagar (Kashmir), Pusa, Coimbatore and Pollibetta (South Coorg). At Pusa the moths occur from October to January.

SIMAETHIS ORTHOGONA, MEYR.

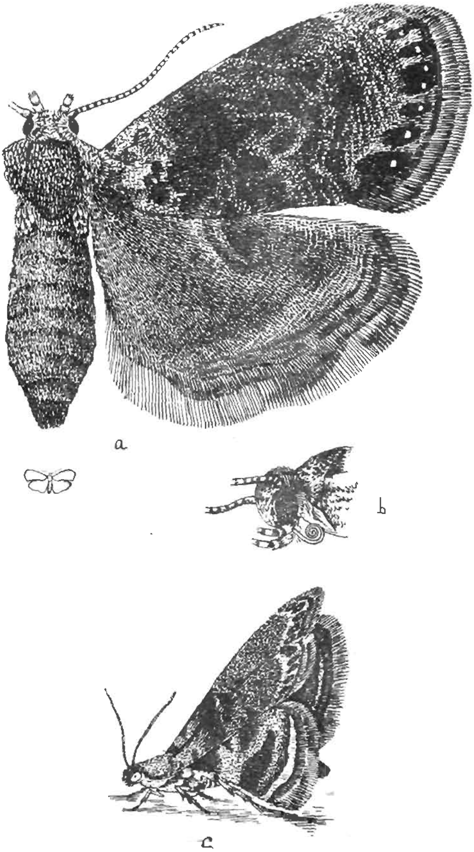
Simaethis orthogona, Meyr., T. E. S., 1886, 287-288(1), Proc. Linn. Soc. N. S. W., XXXII, 114 (1907)(2), Rec. Ind. Mus., V, 226(3), Cat. Glyphipt., p. 35 (1913)(4); Lefroy, Ind. Ins. Life, p. 538 (1909)(5).

Simaethis inscriptana, Snell., Tijds. voor Ent., XVIII, 76, t. 6, f. 6 [♀] (1875) [*nec* ♂](6).

Recorded from India, Burma and Ceylon. Also in New Guinea and Celebes. We have it from Pusa, Chapra, Nadiad and the Shevaroys.

Larva green with a brown head and a row of black tubercles on each side of the body; it feeds on the leaves of *Psoralea corylifolia*, pupating under a slender white cocoon on the leaf(5).

There appears to be some error in the above description. The larvæ have been bred on two occasions at Pusa by A. Mujtaba and the foodplant is recorded as *sahora* or *sahra* (*Streblus* sp.), whilst the larvæ were described as 7 to 8 mm. long, tapering posteriorly, dark grey or honey yellow, head reddish-yellow, segments with numerous black dots from which white hairs arise. Pupa 5 mm. long, light-brown or lemon-yellow, wriggling half-way out



Brenthia coronigera:—*a*. Moth, natural size and magnified (x 16); *b*, side-view of head of moth, magnified; *c*. moth, resting attitude, magnified (x 10).

of the cocoon on emergence of moth. From larvæ taken on 13th July 1906, moths emerged on 21st and 23rd July, and a larva taken on 9th August 1907 formed its cocoon the next day, pupated on 11th August and emerged on 18th August. *(A. Mujtaba's Cage-slips 6 and 34.)*

SIMAETHIS ÆGYPTIACA, ZELLER.

Simaethis ægyptiaca, Zell., Stett. Ent. Zeit, XXVIII, 366 (1867)(1), T. E. S. (3), V, 461, t. 24, f. 1 (1868)(2); Meyr., Cat. Glyphipt., p. 36 (1913)(3); Rebel, Lep. aus. Südarab. und Sokotra, p. 89. (1907)(4).

This species was originally described from Egypt(1, 3) and has since been recorded from the Transvaal(3), India(3) and Sokotra(4).

We have it from Pusa, Chapra and Simla. At Pusa it has been reared from larvæ webbing up tender leaves of *Ficus glomerata*.

SIMAETHIS FABRICIANA, LINN.

Tortrix fabriciana, Linn., Syst. Nat. (xii). 880(1).

Simaethis fabriciana, Meyr., Rec. Ind. Mus., V, 226(2), Cat. Glyphipt., p. 36 (1913)(3), Handbk., p. 707(4).

Recorded from Europe, Asia Minor, Madeira, Canada and British Columbia. Within our limits from Simla and Kashmir. We have it from Dungagali (8,000 feet), Hazara District (May 1915).

"Larva ochreous-whitish, spots pale fuscous; head and plate of 2 pale fuscous; *in a slight web on Urtica and Parietaria*"(4).

BRENTHIA CORONIGERA, MEYR. (PLATE XXXI.)

Brenthia coronigera, Meyr., Exot. Micr., II, 194 (1918)(1).

Bred at Pusa in February from a larva feeding on leaves of *Cordia myxa* (Boraginaceæ)(1).

This species has been bred at Pusa from larvæ feeding on leaves of *Cordia myxa* in February 1917 and 1919 and January 1917. The larva lives on the surface of a leaf under cover of a silken webbing to which stick the black pellets of frass. It gnaws the leaf-tissue in characteristic patches, leaving the other epidermis entire. The portion thus gnawed is covered with the silken webbing.

The larva is about 6 mm. long and about 1 mm. broad across the thoracic region, thence slightly tapering posteriorly, pale yellow with a green tinge; head pale yellow; primary hairs short, arising from tubercles which appear as black spots; some black spots on the head also. Pupation takes place within a cocoon of pure white silken threads and the moths emerge at Pusa during the second half of February. (Pusa Insectary Cage-slip 1516.)

The moths strut about jerkily with the hindwings carried nearly at a right angle with the forewings, so that the wings form a sort of cone when seen from behind the insect. The eyes are pale green. This attitude is characteristic of other species of this genus.

CHOREUTIS BJERKANDRELLA, THNB.

. . . . *bjerkandrella*, Thunb., Diss. Ent., I. 36, t. 3, ff. 23-24 (1784)(1).
Choreutis bjerkandrella, Meyr., Handbk., p. 706 (1895)(2); Spuler, Schmett. Eur., II. 297-298(3); Meyr., Cat. Glyphipt., p. 39 (1913) [synonymy](4).

A cosmopolitan species known from Europe, North, Central and South America, North and South Africa, Western Asia, India, Australia and New Zealand.

Larva described by Spuler; on leaves of *Carlina*, *Inula*, *Carduus*, etc.(3).

Larva green, yellower laterally; spots black; head brown; on *Carduus*, *Inula*, *Eryngium*, etc.(2).

Larvæ were collected at Pusa on *kukronda* (? *Blumea balsamifera*) on 14th January 1910, the moths emerging between 14th January and 5th February. The larva was described as about 7 to 8 mm. long, cylindrical, slightly tapering towards extremities, uniform green; head yellowish-green; hairs arising from small black points, making the larva look minutely spotted under a lens; five pairs of equally developed prolegs. The larva rolls a single leaf, or only the apical portion, or binds one leaf over another or binds together the top leaves; it lives concealed and eats only the epidermis or the epidermis along with the mesophyll substance of the leaf, leaving one epidermal layer entire, so that when the leaf is unrolled the portion eaten appears as a transparent brown spot. Pupation takes place in concealment also in a cocoon of pure white silk lining a rolled-up leaf. The pupa is about 4 to 5 mm. long, cylindrical, tapering posteriorly, dark-coloured, the dorsal side of the anal segment produced into a short thick recurved hook-like process. The pupa wriggles out of the cocoon before the moth emerges. (Pusa Insectary Cage-slip 816.)

The moth is plentiful at Pusa in February and March and occurs less commonly in April and June. We have it from Pusa, Parachinar and Simla.

BLASTOBASIDÆ.

BLASTOBASIS SPERMOLOGA, MEYR.

Blastobasis spermologa, Meyr., Exot. Micr., I, 597 (June 1916)(1).

Described from Ceylon (Maskeliya, Madulsima and Undugoda), from the Wainaad in S. India, and from S. China.

Bred in the Wainaad from tea-seed and at Port Darwin, North Australia, from dried smoked garlic imported from Hongkong([1]).

We have this from Pusa, where it was bred in January 1916 from larva in fallen *gular* (*Ficus glomerata*) fruits.

BLASTOBASIS DECOLOR, MEYR.

Blastobasis decolor, Meyr., B. J., XVIII. 150-151 (1907)([1]), Exot. Micr., I, 596 (1916)([2]).

Originally described from Puttalam in Ceylon([1]). Bred at Coimbatore in October from refuse in fork of tamarind tree([2]), and at Pusa in July 1914 from larva in ripe fallen *gular* (*Ficus glomerata*) fruit.

BLASTOBASIS CRASSIFICA, MEYR.

Blastobasis crassifica. Meyr., Exot. Micr., I, 595-596 (June 1916)([1]).

Described from Madulsima and Pusa([1]). We have it from Pusa and Coimbatore.

Bred at Pusa in March from pods of *Crotalaria juncea*([1]). Larvæ of this genus appear usually to feed on seeds and dry refuse rather indiscriminately without being confined to particular plants([1]).

BLASTOBASIS TRANSCRIPTA, MEYR.

Blastobasis transcripta, Meyr., Exot. Micr., II, 158 (1918)([1]).

"Bred at Almora, 6,000 feet, from twigs of *Pinus longifolia* (*Beeson*). Probably the larva feeds on refuse or in the cones"([1]).

This species was bred at Dehra Dun by Mr. C. Beeson between 8th and 19th September 1915, from *chir* pine twigs attacked by a *Ripersia* scale and collected before 20th August 1915 at Almora (6,000 feet). Mr. Beeson considers that this insect is probably predaceous on the *Ripersia*.

EXINOTIS CATACHLORA, MEYR.

Exinotis catachlora, Meyr., Exot. Micr., I, 599 (June 1916)([1]).

Described from Ceylon (Madulsima and Kalutara) and from Southern India (Nilgiris, 3,500 feet)([1]).

This species has been bred at Pusa from larvæ in flower-heads of *gumma*, which was determined in 1905 as *Leonurus sibiricus* (Labiatæ) and in 1916 as *Leucas* sp. It is not clear whether these foodplants are really identical.

The larva remains hidden in the flower-heads, which show no external signs of injury, and eats the bases of the calyx tubes. It was described in 1906 as about 10 mm. long, cylindrical, uniform yellowish-white, body regularly corrugated: head flat, reddish-black, shiny; a prothoracic shield and five pairs of prolegs. (Insectary Cage-slip 240.)

The larva pupates within a calyx tube in a thin silvery-white silken cocoon. 'The pupa is about 5 to 6 mm. long by 1·75 mm. broad, shining brick-red: head and prothorax bent downwards and thus not visible from above: mesothorax longest: metathorax nearly a third length of mesothorax; eight abdominal segments very distinct; wing-pad of anterior wing reaching base of eighth abdominal segment: spiracles very prominent; a small hair near spiracle on ninth abdominal (anal) segment. (C. S. Misra's Cage-slip of 26th January 1916.)

From larvæ collected on 9th December 1905, and which commenced to pupate on 11th December, moths emerged from 12th February to 10th April 1906, and from flower-heads collected on 26th January 1916 the moths emerged from 28th January to 25th February.

PROSINTIS FLORIVORA, MEYR.

Prosintis florivora, Meyr., Exot. Micr., I, 598 (June 1916)(1).

Described from Madulsima and Pusa(1).

Bred at Pusa in June from larva feeding in inflorescence of *Mangifera indica*(1). Also reared at Pusa in August from larva on mango.

HOLCOCERA PULVEREA, MEYR.

Blastobasis pulverea, Meyr., B. J., XVIII, 151 (1907)(1).

Hypatima doleropa, Meyr., *l.c.*(2).

Hypatima pulverea, Meyr., *l.c.*, p. 638(3); Lefroy, Ind. Ins. Life, p. 536 (1909)(4): Misra, Pusa Bull. 28, p. 24 (1912)(5); Imms and Chatterjee, Ind. For. Mem. (Zool.), III, 31-32, t. 7, f. 24 (1915)(6).

Blastobasis thelymoipha, Imms and Chatterjee, *l.c.*, p. 32 (1915)(7).

Originally described from "India (without further locality). Bred from larvæ feeding on colonies of *Tachardia lacca*"(1) and from the Satpura Range, Khandesh, where it was found "parasitic in lac in company with the Noctuid *Eublemma amabilis*"(2). The name *doleropa* is a synonym of *pulverea*, whilst *thelymorpha* (*thelymoipha* [sic !], Imms & Chatt.) is a *nomen nudum*.

The larva feeds not only on the insect on the tree but in the dry shellac on the cut stick(4 5).

"*Hypatima pulverea* is even more abundant than *Eublemma amabilis* and, in spite of its smaller size, is almost equally destructive. It is common

in all the forests from which we have obtained lac, with the exception of Hoshangabad. In the latter forests we have only bred out six examples from eleven separate consignments of lac. Its larva . . . . . is predaceous, devouring both the *Tachardia* and the lac incrustations and may be found in the lac during the greater part of the year. During the cooler months of December to March the moths are scarce and not often to be met with, but they are abundant during the whole season of April to November. Out of 1,714 moths bred out from lac obtained from various forests in both the United and Central Provinces, only 47 emerged during the months of December to March. The largest number that emerged during any one month was 492 during September.

" The larvæ of this insect are extremely destructive to stick lac and do not appear to be dependent upon living lac growing on the tree. The *Hypatima* larvæ may be found, and the moths bred out, three months after the lac has been removed from the trees . . . . and it by no means follows that once the lac is gathered it may necessarily undergo no further destruction by insects, unless of course it is utilised very shortly after removal from the trees "([6]).

We have this from Kumaon (larvæ on brood lac on *arhar*), Pusa (larvæ on lac-insects on *ber* tree and on stored lac), Pratapganj, Bengal (larva on lac), Berar, C. P. (larva on lac on *Butea frondosa*), Palamau (larvæ on lac on *Schleichera trijuga*), and Coimbatore (reared " from galls ").

The larva is about 10 mm. long and 2 mm. broad, cylindrical, slightly tapering posteriorly, dirty brown ; head bilobed, brown, with fairly long dark hairs, labrum and region immediately above it dark grey or black, frons with an inverted Y-shaped figure brown interiorly but on edges black or dark-grey ; prothoracic shield dark with a narrow medial brown stripe ; thoracic legs ringed with black ; spiracles oval, brown, ringed with black ; five pairs of well-developed prolegs, on which the crochets are arranged in circles.

When full-fed the larva pupates in a thin white silken cocoon in which it sometimes rests for ten days or more before pupating. The actual pupal period is about seven days. Pupa about 5 mm. long and 2 mm. broad with six cremastral hooks and with other hooks with recurved tips on abdominal segments, these hooks entangled in the silk of the cocoon. (Insectary Cage-slip No. 665.)

The genus *Hypatima*, Hb., in which this species has been placed hitherto in Indian literature, belongs to the Gelechiadæ. *Holcocera*, Clemens, is identical with *Hypatima*, H. S. (*nec* Hb.) ; see Walsingham, *Ent. Mo. Mag.* 1909, pp. 48-51.

SCYTHRIDIDÆ.

The early stages of no Indian species appear to have been observed. The larvæ of some of the European species are leaf-miners when young, sometimes gregariously, but when older spin leaves together and feed on the cuticle. (See Stainton, *Nat. Hist. Tin.*, XII, 70, t. 3.)

ELACHISTIDÆ.

Only a few Indian species of Elachistidæ have been described and the life-history of none is known. In Europe the larvæ mine the leaves of Gramineæ and Cyperaceæ chiefly. (See Stainton, *Nat. Hist. Tineina*, Vol. III.)

HYPONOMEUTIDÆ.

ARGYRESTHIA IOPLEURA, MEYR.

Argyresthia iopleura, Meyr., Exot. Micr., II, 187 (1918)(1).

Bred at Almora (6,000 feet) from twigs of *Pinus longifolia* (*Beeson*) probably feeding in the shoots(1).

PRAYS CITRI, MILL. (PLATE XXXII, FIG. 1.)

Acrolepia citri, Millière, Pet. Nouv. Ent., V. 310 (1873)(1).

Prays citri, Mill., Icon., t. 150, ff. 17-20(2) ; Spuler, Schmett. Eurp., II, 442(3) ; Grandi, Disp. Ent. Agr., pp. 287-288, f. 285(4) ; Essig, Calif. Mthly. Bull., II, 722-723, f. 389 (1913)(5) ; Meyr., B. J., XXIII, 125 (1914)(6) ; Fletcher, Entom. Note No. 89, f. 16 (1916)(7) ; Quayle, U. S. A., Agr. Dept. Bull. 134, p. 22 (1914)(8) ; Proc. Second Entl. Meeting, pp. 17, 212 (1917)(9).

Prays nephelomima, Meyr., Pr. Linn. Soc. N. S. W., 1907, 76(10).

A widely-distributed species recorded from the South of France, Corsica(1-4) Sicily(3, 4, 5), the Canary Islands, New South Wales(10) and the Philippines(5, 6). Within our limits known to occur in Ceylon (Colombo, Maskeliya and Madulsima)(6), in North Coorg(6), and at Pusa(9) and will doubtless be found to be widely distributed in India. We have specimens from Maskeliya and Pusa.

The larva has been recorded as a serious pest of the orange and other species of *Citrus*, feeding in the shoots and eating into all the flower organs, whilst in the Philippines the larva has been found to make a gall in the rind of orange fruits.

Eggs are deposited apparently upon the calices or peduncle of the flower, usually just prior to opening, the young larvæ boring through into the interior of the flower, which is destroyed ; pupation usually within the flower, but also in protected places on the leaves or forks of the twigs and branches(8).

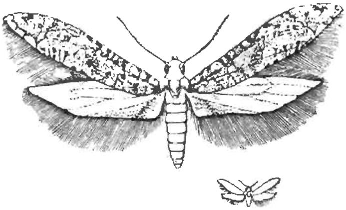
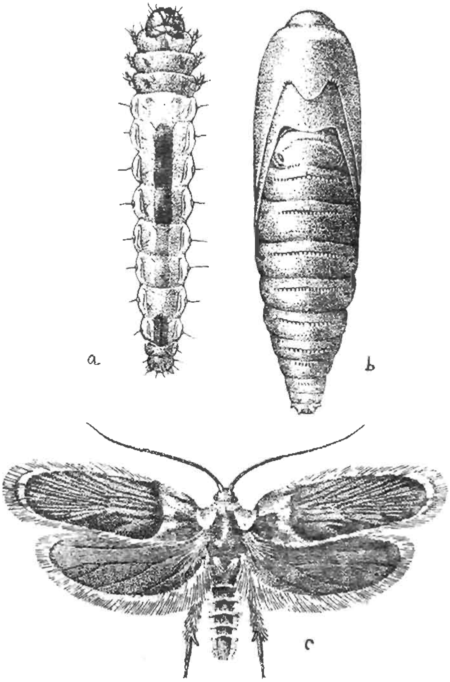


Fig. 1. *Prays citri.* (The small outline figure shows the natural size.)



ig. 2. *Comocritis pieria*:—*a*. Larva; *b*. pupa; *c*. moth; all magnified (x 9).

HYPONOMEUTA MALINELLA, Z.

Hyponomeuta malinellus, Zeller, Isis 1844, 220; Wlsm., P. Z. S., 1885, 883.

Recorded from Poona by Lord Walsingham but probably in error. It is not otherwise known to be Indian, although quite likely to be (or to have been) introduced with garden shrubs. Its distribution includes Central and Southern Europe, Asia Minor and Japan.

HYPONOMEUTA LAPIDELLA, WLSM.

Hyponomeuta lapidellus, Wlsm., P. Z. S., 1880, 86, t. 12, f. 1.

Described from Dharmsala(1).

" Larva pale yellowish ochreous, with a double row of elongate black spots just touching each other on the middle of each segment, and connected by a slender black subdorsal line, except between the third and fourth segment, where it is interrupted by a band of the pale ground-colour. Below the subdorsal line is a row of reniform black spots on each segment after the fourth. Head black; second segment with two brownish-fuscous plates divided by a yellowish line. Anterior legs black; prolegs yellowish ochreous; a few single scattered hairs on each segment. Larvæ found at an elevation of about 4,500 feet near Dharmsala, 12th July, feeding on " soongroo " (wild *Salvia*); moths emerged 1st August(1).

ATTEVA FABRICIELLA, SWED.

Tinea fabriciella, Swederus, Kngl. Svensk. Vet. Ak. nya Handl., VIII, 277 (1787)(1).

Corinea niviguttella, Wlk., Cat., XXVIII, 542-543 (1863)(2).

Atteva fabriciella, Wlsm., in Swinh. Cat. Het. Oxf. Mus., II, 559 (1900)(3); Fletcher, S. Ind. Ins., pp. 461-463, f. 338 (1914)(4).

Common throughout Southern India, from Bombay and Nagpur southwards. Also known from Borneo.

" The eggs are creamy-white, rounded, flattened, and beautifully sculptured; they are laid, usually on the lower surface of leaves, either singly or in small groups. The caterpillars live gregariously in a common web of fine silk spun over the leaves and shoots of the foodplant, which, in conjunction with larvæ of *Eligma narcissus*, they may sometimes completely defoliate. The full-grown caterpillar is about 20 mm. long, moderately stout, smooth, with scattered short hairs arising from small whitish warts, head blackish, body greenish-grey with paler longitudinal stripes, one faint one down the back edged on either side by a more distinct stripe, and a well-defined stripe along each side. Pupa orange-brown, in a transparent boat-shaped cocoon spun

n the common web; pupal period about ten days. Foodplants:—*Ailanthus* *excelsa* "(4).

We have this species from Coimbatore, Trimulgheri, Nagpur and Ahmeda-bad, in all cases bred on *Ailanthus*.

ATTEVA NIVEIGUTTA, WLK.

Attera niveigutta, Wlk., Cat., II, 526-527 (1854)(1); Moore, P. Z. S., 1867 669(2); Wlsm., *in* Swinh. Cat. Het. Oxf. Mus., II. 558 (1900)(3).

Recorded from Bengal(2, 3) and Sylhet(1, 3). Lord Walsingham's record(3) of its occurrence in China is probably an error for *A. brucea*, Mo. We have it from Sikkim and ? Bhutan.

Larva feeds on *Ailanthus excelsus*, residing in a common very fine web, at times a perfect pest, denuding the tree of its leaves (*Bonavia*)(2).

ÆTHERASTIS CIRCULATA, MEYR.

Ætherastis circulata, Meyr., Exot. Micr., II, 190 (1918)(1).

Bred at Trevandrum, Travancore, in May from larva on *Eugenia jambolana*(1).

COMOCRITIS PIERIA, MEYR. (PLATE XXXII, FIG. 2.)

Comocritis pieria, Meyr., B. J., XVII, 416 (1906)(1); Antram, Bark-eating Borers of Tea, pp. 16-17, f. 9 (1907)(2).

Originally described from Neboda, in Ceylon(1). Also recorded from Assam(2), Duars(2), Cachar(2) and Sylhet(2). We have it from Matale (Ceylon).

Larva in galleries on bark of *Hevea brasiliensis* (Para Rubber)(1). Larva pale yellow, much flattened, about 12 mm. long; head brown, thoracic segments enlarged. It forms a thin silken web, exactly resembling the bark of tea-bushes in colour; this often covers a considerable portion of the stems, chiefly, however, the thicker branches, low down portions of the bush, and the under side of overhanging branches, this last being a very favourable site. The larva only eats a thin layer of bark from the surface. Pupa under the larval web. Adult emerges in April and May. Foodplant; tea(2).

"*In Cachar and Sylhet, where the old style of pruning is still kept up . . . . . these insects are more plentiful*". Checked in Assam by removal at pruning time of all twiggy growth, dead wood, etc. (Andrews, *in litt.*, 7th March 1916).

ETHMIA ASSAMENSIS, BUTL.

Hyponomeuta assamensis, Butl., T. E. S., 1879, 6(1).
Azinis assamensis, Cotes and Swinh., Cat. Moths Ind., p. 719 (1889)(2).

Ethmia assamensis, Durrant, P. Z. S., 1906, 496([3]) ; Meyr., Cat. Hyponomeuta, p. 27 (1913)([4]).

Psecadia hockingella, Wlsm., P. Z. S., 1880, 90-91, t. 12, ff. 8, 9, 9*a*([5]).

Occurs from Kashmir and Dharmsala along the Himalayas to Sikkim, Cachar and the Naga Hills. We have it from Khatmandu (Nepal).

Larva on " Poonah " (probably *Ehretia serrata*) in April and May at Dharmsala. Described([5]) as " wonderfully active with a snake-like motion, exceedingly swift, either backwards or forwards at pleasure " (*Hocking*).

Description of preserved larva :—" pale yellow and black, with a tinge of orange at the side of each segment. Head black with a pale yellowish stripe across the face, second segment orange and black. Along the middle of back is a row of conspicuous pale yellow spots, two on each segment after the third, the anterior spot slightly indented at the sides and behind, sharply indented in front with black, the second somewhat square, with a black spot in its centre. On each side of the back is a reduplicated black stripe, containing about three pale yellowish spots on each segment. The sides of the segments about the spiracles are pale yellowish with an orange tinge, spotted with black ; and above the legs runs a narrow black festooned stripe. There are several wart-like tufts of thinly growing hairs on each segment. Anterior legs black, prolegs pale yellowish "([5]).

ANTICRATES LUCIFERA, MEYR.

Anticrates lucifera, Meyr., B. J., XXIII, 128-129 (1914)([1]).

Described from Karwar, in North Kanara ; larva on *Sideroxylon tomentosum* (*Sapotaceæ*) ; cocoon on leaf([1]).

COLEOPHORIDÆ.

The early stages of no Indian species seem to be known.

Outside of India, the members of the genus *Coleophora* usually mine in leaves or seeds as young larvæ, later on living in a portable case, composed of cut fragments of leaf fastened together with silk, or of the empty husk of a seed which they have eaten out. The larvæ have all legs present, but the abdominal prolegs are little developed, as they are not used for walking ; plate of 2 well-developed, usually dark and divided medially ; plates of 3 and 4 usually developed, divided medially and transversely ; plate of 13 developed. Numerous life-histories in this group are described in Volumes 4 and 5 of Stainton's ***Natural History of the Tineina.***

Rhadinastis **contains an Australian species whose larva is a true gall-producer on *Acacia*.**

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA

VI. GRACILLARIADÆ

BY

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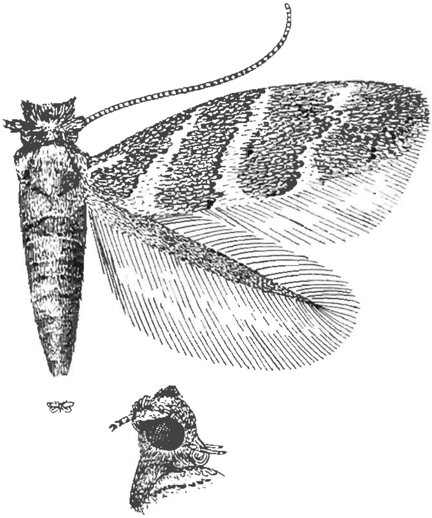
PLATE XXXIII.



Lithocolletis triarcha:—Moth, natural size and magnified. Below is seen a side-view of the head, considerably magnified.

LIFE-HISTORIES OF INDIAN INSECTS. MICROLEPIDOPTERA.

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Imperial Entomologist.

(Received for publication on 27th June 1919.)

LITHOCOLLETIS TRIARCHA, MEYR. (PLATE XXXIII.)

Lithocolletis triarcha, Meyr., B. J., XVIII, 811 (1908)(1); Lefroy, Ind. Ins. Life, p. 537 (1909)(2).

Described from Pusa, where it was reared from larvæ mining leaves of cotton(1). Lefroy(2) gives the foodplant as tree-cotton, but most varieties of cotton may be attacked.

Larva flattened, but all * legs present; mines lower surface of leaf; pupation in mine(2).

This species is common at Pusa on cotton, especially on American varieties, and is probably widely distributed in the Plains, although not yet noted elsewhere. The larva mines the lower surface of the leaf which turns yellowish white with brown spots. The larva is about 4 mm. long, segments distinct, tapering posteriorly; head small, pointed anteriorly, greenish or yellow; prothorax broad with two brownish spots separated by a greenish band; other segments yellow with a pinkish or greenish tinge, skin rather transparent especially on sixth to eighth abdominal segments; anal shield green, shiny; primary hairs short; legs short; yellow or green; prolegs on third to fifth

* This statement is incorrect and based on an erroneous statement in A. Mujtaba's Cage-slip 9.

abdominal segments, together with the anal claspers. Pupation takes place inside the mine, in a white silken cocoon. Pupa about 2·5 mm. long, brown. A large proportion of the larvæ are parasitized. (Umrao Bahadur's Cage-slip 20.)

LITHOCOLLETIS VIRGULATA, MEYR. (PLATE XXXIV.)

Lithocolletis virgulata, Meyr., B. J., XXIII, 118-119 (1914)(1), Exot. Micr., II, 5-6 (1916)(2).

Originally described from Karwar, where it was bred from cocoons found on *Ficus*(1).

Reared at Pusa from " larvæ mining blotches on upper surface of leaves of *Butea frondosa*, pupating within the mine. This is normal for the genus and is doubtless correct, but does not accord with Mr. Maxwell's account of the original specimens, bred from cocoons 'unusually large for the size of the moth' found exposed on leaves of a tree at first stated to be a *Ficus* but this identification was subsequently withdrawn ; it seems likely that there must have been some error here, and that the moths did not really emerge from these cocoons ".

Mined leaves of *Butea frondosa*, containing larvæ and pupæ, were found at Pusa on 22nd February 1916 and 11th March 1916. The mines are situated on the upper surface of the leaf. Pupation takes place within the mine in a thin cocoon woven beneath the epidermis of the leaf. A large proportion of the larvæ are parasitized by a small Hymenopteron, of which four to six grubs are found in each larva, these grubs pupating inside the body of the host which becomes twisted up like a rope (figure 2). (C. S. Misra's Cage-slip, dated 22nd February 1916.)

LITHOCOLLETIS CONISTA, MEYR. (PLATE XXXV, FIG. 1.)

Lithocolletis conista, Meyr., E. M. M., XLVII, 212-213 (Sept. 1911)(1), Wytsm. Gen. Ins. fasc., 128, p. 8, tab., f. 11 (1912)(2), Exot. Micr., I, 622 (1916) [description amended](3).

Described from Pusa, where it was reared from larvæ mining leaves of *Triumfetta neglecta* (Tiliaceæ)(1).

Larvæ were found at Pusa on 3rd June 1910 mining under the epidermis of the under surfaces of leaves of *Triumfetta neglecta*. Many larvæ feed in one leaf, each mining an area of about one-seventh to one-fifth of a square inch. The mines are of an irregular shape, usually bounded by the larger leaf-veins, as the larvæ never cross such veins. The larvæ eat very little of the mesophyll substance and a newly-attacked leaf is hardly distinguishable

PLATE XXXIV

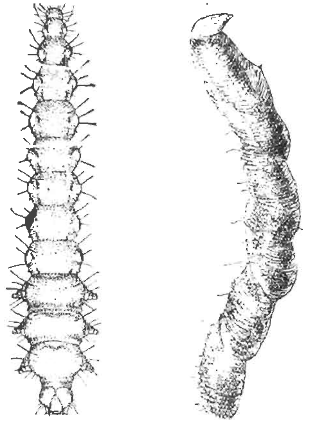


Fig. 1. Larva and parasitized larva (X 16).

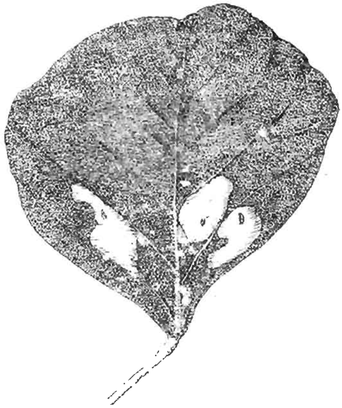


Fig. 2. Mined leaf of *Butea frondosa* with empty pupa-cases protruding.

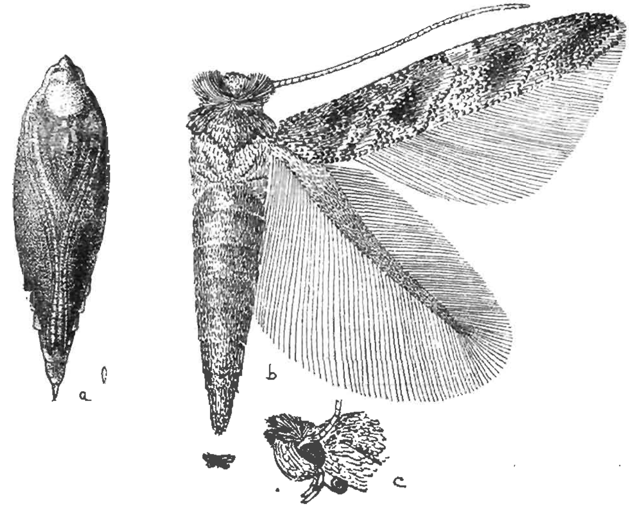


Fig. 3. *a*, Pupa, natural size and magnified (x 20) ; *b*, moth, natural size and magnified (x 26) ; *c*, side-view of head of moth, highly magnified.

LITHOCOLLETIS VIRGULATA.

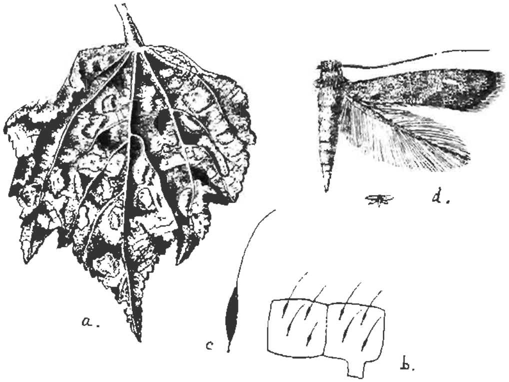


Fig. 1. *Lithocolletis conista*:—*a*. Leaf of *Triumfetta neglecta*, mined by larvæ; *b*, arrangement of setigerous tubercles on larval segments; *c*. a single hair, more highly magnified; *d*. moth, natural size and magnified (x 12).

Fig. 2. *Epicephala chalybacma*:—Moth, resting posture.

from above, but when the larvæ pupate it is easily distinguished on account of its crumpled appearance.

When full-grown the larva is about 3·5 mm. long, slightly flattened and slightly tapering posteriorly, segments distinct, thoracic much broader than abdominal segments; head pale yellow tinged with brownish, much smaller than prothorax, flattened, tapering anteriorly; general colour very pale yellow, the green contents of alimentary canal showing through the transparent skin, prolegs only on third to fifth abdominal segments together with the anal claspers; hairs on segments long and thickened a little above the base, there being four such hairs on each segment. Before pupation the colour changes to orange-yellow.

The larva pupates inside its mine. First the two opposite edges of the mine are drawn closer by means of silken threads passed across; then a white silken cocoon is formed by lining this cavity with silk. The leaf becomes crumpled on account of the edges of all the mines being drawn together in this way.

The pupa is about 3 mm. long from head to anal extremity, cylindrical, tapering posteriorly, yellow; head prolonged into a pointed process, as is also the dorsal portion of the anal extremity; long hairs, bent posteriorly scattered on the segments; sixth abdominal segment ventrally with a paired lateral stiff blunt process on its posterior portion.

Before emergence of the moth, the pupa wriggles out at one end of the cocoon for more than half its length, its ventral surface held away from the surface of the leaf. (Insectary Cage-slip 838.)

LITHOCOLLETIS ITEINA, MEYR.

Lithocolletis iteina, Meyr., Exot. Micr., II, 173 (1918)(1).

"Bred at Pusa in March from larvæ mining blotches on underside of leaves of *Salix*"(1).

This species was reared at Pusa from larvæ found mining leaves of *Salix* sp. on 27th February 1916. The larva mines beneath the epidermis on the under surface of the leaf, there being usually only one larva in the same leaf. The epidermal layer, under which the larva works, becomes detached from the leaf tissue and contracts to a certain extent longitudinally, so as to form a sort of rib. The internal tissue of the leaf is not much eaten; hence the mine is hardly visible from the upper surface in most cases. In some cases, however, portions of the mesophyll tissue are nibbled and some scattered yellow spots appear on the upper surface. The larva is about 3 mm. long and 0·5 mm. broad across midbody, cylindrical, tapering posteriorly, segments

distinct, transparent whitish, fourth to eighth abdominal segments tinged with yellow; head much smaller than prothorax, shiny, pale brownish, mouth-parts brown; tubercles on body bearing long pale whitish hairs; second to eighth abdominal segments with a large black hemispherical dorsal spot; prolegs only on third to fifth abdominal segments, together with the anal claspers.

Pupation takes place inside the mine. The pupa is dirty brown, about 4·5 mm. long and 0·75 mm. broad across the thoracic region, cylindrical, tapering posteriorly; head produced into a sort of short beak bent ventrally. Before emergence of the moth the pupa wriggles out of the mine to a certain extent and the empty pupa-case is left protruding from the mine. The moths emerged between 1st and 15th March and several Hymenopterous parasites were also bred. (Tahl Ram's Cage-slip 141.)

LITHOCOLLETIS CLARISONA, MEYR.

Lithocolletis clarisona, Meyr., Exot. Micr., 1, 622 (1916)([1]).

Bred at Peradeniya in July from mines in leaves of *Urena lobata* (Malvaceæ) (*Rutherford*)([1]).

LITHOCOLLETIS BAUHINIÆ, STT.

Lithocolletis bauhiniæ, Stainton, T. E. S. (n.s.), III, 303-304 (1856)([1]).

Described from Calcutta([1]).

Larva mines the upper cuticle of the leaves of *Bauhinia purpurea* in irregular circular or oval patches, the leaf remaining uncontracted. Before changing to pupa, the larva spins a slight silken cocoon, drawing together the two cuticles of the leaf in the centre of the mined part, and forming almost an exact circle (*Atkinson*)([1]).

LITHOCOLLETIS DORINDA, MEYR.

Lithocolletis dorinda, Meyr., Exot. Micr., I, 21 (1912)([1]).

Described from Pusa, where it was reared from larvæ mining leaves of *Desmodium* (Leguminosæ)([1]).

This species has been reared at Pusa from *Desmodium* leaves collected on 31st July 1907. The larva apparently mines the leaf although it does not seem to have been noted and our specimens were reared from pupæ found inside the mines, three pupæ being found in one mine. The pupa was described as 2 mm. long, tapering considerably posteriorly, yellowish-brown. (A. Mujtaba's Cage-slip 26.)

LITHOCOLLETIS GANODES, MEYR.

Lithocolletis ganodes, Meyr., Exot. Micr., II, 172 (1918)(1).

"Bred in October from larva mining leaf of *Pyrus malus*"(1) at Parachinar, Kurram Valley, N. W. F. Province.

LITHOCOLLETIS INCURVATA, MEYR.

Lithocolletis incurvata, Meyr., Exot. Micr., I, 622 (1916)(1).

"Bred at Karwar, North Kanara, in August from larvæ mining blotches in leaves of *Strobilanthes callosus* (Acanthaceæ)"(1).

LITHOCOLLETIS NEODOXA, MEYR.

Lithocolletis neodoxa, Meyr., Exot. Micr., I, 621 (1916)(1).

Bred at Pusa in August from larvæ mining in leaves of *Cajanus indicus*.

This has also been reared at Pusa from larvæ found mining leaves of *Rhynchosia* sp. (? *R. minima*) (Leguminosæ) on 31st August 1917. The mine commences as a yellowish-white patch at about the centre of the upper surface of the leaflet. By the time the larva is full-grown the mine extends over the whole of the upper surface and looks like a yellowish-white thin membranous covering. From the under surface in most cases hardly anything is perceptible but in a few cases, when the mesophyll tissue has been nibbled, faint spots are to be seen. The larva pupates inside the mine under cover of the membranous pellicle. A silken cocoon is formed and the two halves of the blade of the leaflet are partially drawn towards each other, the leaflet assuming the shape of a boat. The pupa wriggles out through one end of the cocoon and through the membranous pellicle before the moth bursts out of the pupa-case and the empty pupa-case remains partly protruding through the pellicle. Moths emerged between 3rd and 7th September. (Insectary Cage-slip 1668.)

PHRIXOSCELES PLEXIGRAPHA, MEYR.

Phrixosceles plexigrapha, Meyr., Exot. Micr., I, 623 (1916)(1).

"Reared at Pusa and Coimbatore from larvæ feeding in pods of *Cajanus indicus*"(1).

This species has been reared at Pusa from a larva found on 23rd March 1914, mining the surface of a green *arhar* (*Cajanus indicus*) pod on which broad zigzag whitish markings had been produced. When full-fed the larva emerged from the mine and pupated in a corner of the cage in a white membranous cocoon covered with a number of small globules such as are found on the cocoon of *Epicephala chalybacma*. Pupal period five days, the moth emerging on 8th April. (Insectary Cage-slip 1038.)

EPICEPHALA CHALYBACMA, MEYR. (PLATE XXXVI.)

Epicephala chalybacma, Meyr., B. J., XVIII, 811 (1908)(1), Exot. Micr., I 21-22 (1912)(2); Green, Pr. Ent. Soc., 1912, pp. cvii-cix, figs. (1913)(3).

Originally described from Peradeniya(1), this species has been recorded from Pusa(2) and also occurs at Calcutta, Nagpur, Serampore, Coimbatore and at Minbu in Lower Burma, and probably wherever *Cæsalpinia* (*Poinciana*) *pulcherrima* is grown in the Plains of India.

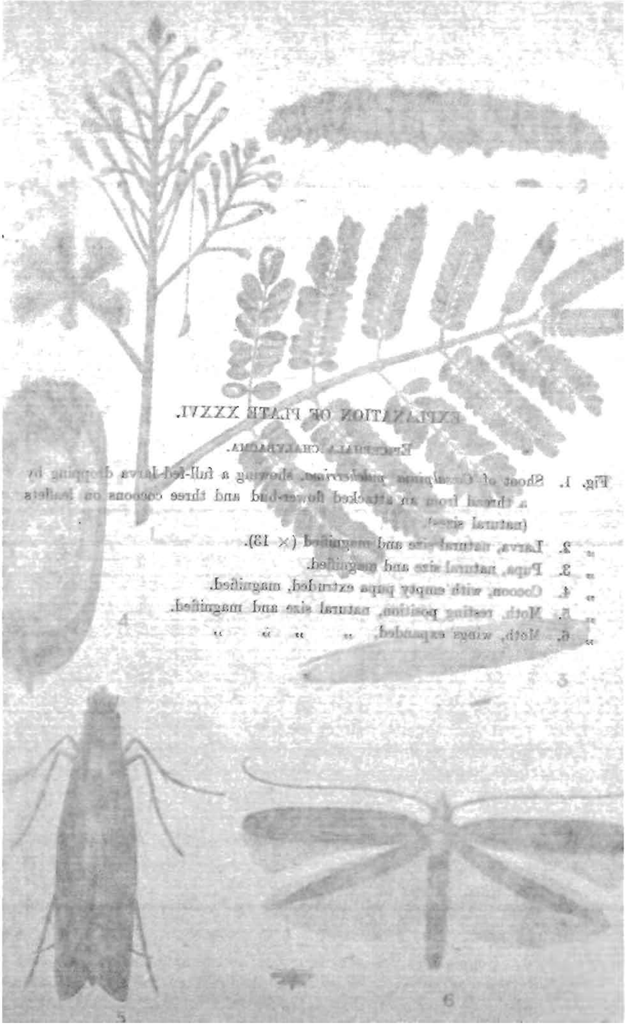
Larva without prolegs on 10, pale greenish-yellow; head yellow; when full-grown, with a red band on each of segments 2-12, a red spot on 13; feeds inside unexpanded flowers of *Poinciana pulcherrima* (Leguminosæ), showing no outward sign; when full-grown, it gnaws its way out and pupates in a white cocoon covered with bubbles, usually on the upper surface of a leaf (*Fletcher*)(2).

Foodplants :—*Poinciana pulcherrima*(2), *Pithecolobium saman*(3).

"Larva small, but robust, measuring—when extended—about 6 mm. It is of a dull, pale, translucent green colour, with an irregular crimson band completely encircling each segment"(3).

The egg, which is small, whitish, elliptical in outline and somewhat flattened, is laid on the unopened flower-buds of the foodplant, which is usually *Cæsalpinia* (*Poinciana*) *pulcherrima*, a common ornamental shrub in Indian gardens, although this species has been found also on gold mohur (*Poinciana regia*) at Pusa and on the rain-tree (*Pithecolobium saman*) at Peradeniya. The proximal face of the egg is flattened and the distal end rounded, with several parallel longitudinal striæ. The larva, on hatching, bores into the bud and feeds mainly on the stamens and but rarely on the ovary. The entrance hole is too small to be noticed and also is probably closed by growth of the flower; at any rate, no outward sign of damage is noticeable, although the bud may contain a full-grown larva and be filled with its reddish-brown pellets of excrement. The young larva is uniform pale greenish-yellow. When full-grown it is about 6 mm. long and 1·3 mm. broad across mid-body, tapering in both directions, body segments distinct, skin soft; head yellow; other segments pale green with a crimson band which is continued, although interrupted, around those segments which do not possess legs or prolegs; anal segment with a dorsal crimson spot; prolegs only on third to fifth abdominal segments, with the anal claspers.

When full-fed the larva gnaws its way out of the flower and usually drops by a silken thread on to the upper surface of a leaflet, where it forms a most curious cocoon, whose upper surface is ornamented with small bubbles. Occasionally this cocoon is formed on the lower surface of a leaflet. The



EXPLANATION OF PLATE XXXVI.

EPICEPHALA CHALYBACMA.

Fig. 1. Shoot of *Cæsalpinia pulcherrima*, showing a full-fed larva dropping by a thread from an attacked flower-bud and three cocoons on leaflets (natural sizes).

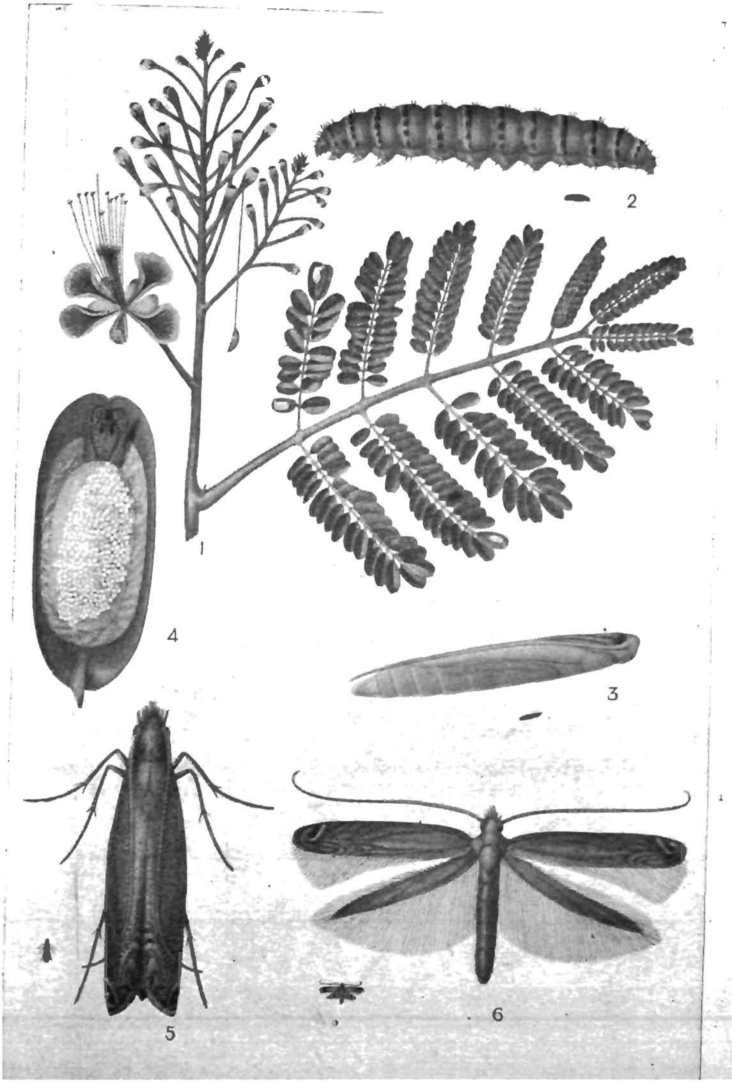
„ 2. *Larva, natural size and magnified* (× 13).

„ 3. Pupa, natural size and magnified.

„ 4. Cocoon, with empty pupa extruded, magnified.

„ 5. Moth, resting position, natural size and magnified.

„ 6. Moth, wings expanded, „ „ „


1
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cocoon, which is pure white, measures about 5 to 6 mm. in length and about 2·5 to 3 mm. in breadth, but the ground-work is much larger and may extend over the entire surface of a leaflet. The larva first of all applies a layer of silk over the surface of the leaf and this forms the ground-work, and then it begins to cover itself by forming the roof of the cocoon. Subsequent proceedings, and particularly the method of formation of the bubbles, may perhaps be best described in Mr. Green's words :—

"The remarkable little cocoons . . . . are attached to the leaves and stems of many different plants, to posts and railings or to any material that may happen to be in the neighbourhood. These white cocoons are elongate, with a median ridge or crest composed of minute glistening globules, the nature of which has hitherto puzzled me. I could never find the caterpillars that were responsible for the structures. One particular post, that was constantly ornamented with the cocoons, has been watched day and night for some time. I naturally expected to find the caterpillars making the ascent. The ground at the base of the post was scanned minutely, but no wandering caterpillars were to be found. It really seemed that, if they did not come up from below, they must come down from above. One morning after concluding my search, I instinctively glanced upwards, and there—sure enough—were several minute larvæ, hanging by long silken threads from the overspreading branches of an *Inga-saman* tree (*Pithecolobium saman*). They had let themselves down from a height of 30 or 40 feet, and were swinging in the breeze. This part of the mystery was now solved. They hung suspended until the wind drove them against something solid, and there they immediately attached themselves and constructed their cocoons. The construction of the cocoon is commenced immediately the caterpillar obtains a foothold. The position appears to be a matter of no consequence. The work is completed within two hours, which accounts for my failure to find uncovered larvæ. After weaving a thin silken covering, the creature rests for a few moments, and a convulsive movement of the posterior segments is noticeable. Very soon a globular pellet—apparently composed of dried bubbles—is voided whole. The caterpillar then turns round inside the cocoon, rapidly attaches the globule to the roof of the cocoon by a stout silken cord, bites a small hole close to the point of attachment, and pushes the globule and cord up through this aperture. The rent is then quickly repaired. This is followed by another short pause, the evacuation of a second pellet, and a repetition of the previous performance, the second pellet being placed at the opposite extremity of the cocoon, in consequence of the caterpillar having reversed its position in the cocoon. The same movements are continued, until the complete crest of

globules is in position, when the labours of the little animal are over, and it composes itself for pupation. The number of pellets probably varies, but—*in one cocoon—I have counted more than forty of these little objects* "(3).

These observations have been corroborated by Y. Ramachandra Rao and by Mrs. Drake, of Serampore. The former, in a note dated July 1916, wrote :—" These cocoons are remarkable owing to the fact that they are ornamented on the upper surface by a collection of numerous bubble-like balloonets. These are prepared at the hind end of the alimentary canal of the caterpillar and ejected, whereupon the larva makes a slit on the top of the cocoon, attaches a *thread to the bubble, pushes it out, and then patches up the roof.* Each balloonet, when examined carefully, is found to be made up of several chambers ". Mrs. Drake, in a letter dated 5th May 1914, wrote :—" The cocoons are generally made on the leaflets, and it is the making of the cocoon that is so exceedingly interesting. The caterpillar, after enclosing itself in so thin a covering that its red bands are still quite conspicuous, makes a little globule and, parting the threads at one end of its cover, thrusts out the globule. For five minutes it spins again, then turns completely round and thrusts another globule out at the other end. This it continues to do till its cocoon is covered with the glistening globules, taking five minutes for each globule and thrusting them out from alternate ends till they join in the middle of the cocoon. The way the globules come out is more like soap-bubbles than anything I can think of—indeed, I wrote my little daughter that I had found a caterpillar blowing soap-bubbles. The cocoons I have had under observation have been made in the morning and the moth has emerged in the evening of the seventh day ". As the bubbles are thrust out, the cuts are closed with more silk applied from within. In this manner nearly the whole of the cocoon may be covered with these stalked bubbles. In a completed cocoon no openings can be seen and the stalks of the bubbles appear to arise from the surface of the cocoon. As regards the object of these bubbles, it has been suggested that enemies may be deluded into supposing that they are empty cocoons of parasites and that the cocoon is therefore untenanted. The larva is, however, subject to attack by Chalcidid and Braconid parasites. It may be noted that in the allied North American genus *Marmara* the exterior of the cocoon of *M. salictella* is described as " covered with little froth-like globules, which resemble minute pearls ". (Clemens, *Tineina of North America*, p. 212 (1872).)

The larva pupates inside this cocoon and the moth emerges after six or seven days. The pupa is about 4 mm. long, cylindrical, and rather less than 1 mm. broad, light yellow with a greenish tinge, the eyes black and prominent

in advanced stages; the wing-cases reach to the sixth abdominal segment, the antenna-cases almost exceed the anal extremity and are a little longer than the hindleg-cases. The pupa wriggles out of the cocoon to some extent before emergence and the empty pupa-case is left protruding from the cocoon.

Although the cocoons are seen abundantly on leaves of *Cæsalpinia pulcherrima* and the larvæ may be found commonly in the flower-buds, the moth is less commonly seen. It sits in the characteristic Gracillariad position, with the head raised and the hinder extremity resting on the surface (Plate XXXV, fig. 2).

EPICEPHALA ALBIFRONS, STT.

Ornix ? albifrons, Stainton, T. E. S. (n.s.). V. 122 (1859)(1).
Epicephala albifrons, Meyr., B. J. XVIII, 813 (1908)(2): Rec. Ind. Mus., V, 227(3).

Originally described from Calcutta, *E. albifrons* has since been recorded also from Purneah(3), North Coorg(2) and Travancore(3).

This species has been bred at Pusa from larvæ found in fruits of *jar-amla* (*Phyllanthus Niruri*), and we have it also from Katihar and Bassein Fort (Bombay).

Larvæ were found at Pusa on 19th November 1911 in fruits of *Phyllanthus Niruri*, feeding on the contents of the fruits. The young larva was described as 3 mm. long, cylindrical, slightly tapering posteriorly, segments distinct, head smaller than prothorax, pale yellow: all other segments with a deep pink broad ring running all around them, the intersegmental portions pale yellow (turning light blue prior to pupation), the pink ring interrupted dorsally on prothorax and the rings on metathorax and first abdominal segment conjoined; prolegs only on third to fifth abdominal segments, besides the anal claspers. The gait of the larva is rather semi-looping. When full-grown the larva emerges from the fruit and pupates in any convenient nook in a cocoon formed under the shelter of a covering. From larvæ collected on 19th November three moths emerged between 13th and 23rd December 1911, but one larva was observed to be still resting in its cocoon on 15th January 1912 and remained in this condition until 2nd July 1912; on 1st August it was noted that the larva, which had been green until then, had turned yellow and appeared to be going to pupate and by the next day it had pupated, the moth emerging on 8th August 1912. The occurrence of this larval resting condition is noteworthy and may be compared with the long-cycle larvæ of *Platyedra gossypiella*. The pupa wriggles out of one end of the cocoon to some extent before emergence of the moth. (Pusa Insectary Cage-slip 921.)

ACROCERCOPS PENTALOCHA, MEYR.

Acrocercops pentalocha, Meyr., Gen. Ins. fasc., 128, p. 15 (1912)(1), B. J., XXIII, 112 (1914)(2).

Bred at Karwar, in North Kanara, in August from larva mining blotches in leaves of mango (*Mangifera indica*); pupa in external white flat oval cocoon (*Maxwell*)(2).

ACROCERCOPS ORDINATELLA, MEYR.

Gracilaria ordinatella, Meyr., Proc. Linn. Soc. N. S. W., V, 145 (1880)(1).
Conopomorpha ordinatella, Meyr., *l.c.*, XXXII, 54 (1907)(2).
Acrocercops ordinatella, Meyr., B. J., XVIII, 816 (1908)(3), Exot. Micr., I, 285 (1914)(4); Fletcher, Pusa Bull. 59, Note 85 (1916)(5); Meyr., Exot. Micr., I, 624-625 (1916) [redescr.](6).

Originally described from New South Wales(1), this species also occurs in Queensland(2), Ceylon(3, 4), Coorg(6), Mysore(5), Kanara(6) and apparently in Burma(5). We have it from Mysore and Virajpet (South Coorg).

It has been reared in July at Peradeniya from larva mining leaves of *Litsea* and is also a pest of camphor, mining in the leaves(5).

" Larva cylindrical, segments rather strongly marked, wholly orange, with tinge of crimson; mining blotch in upper side of leaf of *Alseodaphne semecarpifolia* (Lauraceæ) and an unidentified shrub (also recorded from *Litsea*, therefore probably feeds on several Lauraceæ); cocoon oval, orange, external, but occasionally within blotch, with two or three bubbles attached (*Maxwell*)"(6).

Meyrick(6) says that the " brilliant amber-yellow " larvæ described by Stainton under the name *quadrifasciata* [*q. v.*] " are presumably *ordinatella*."

ACROCERCOPS SUPPLEX, MEYR.

Acrocercops supplex, Meyr., Exot. Micr., II, 175 (1918)(1).

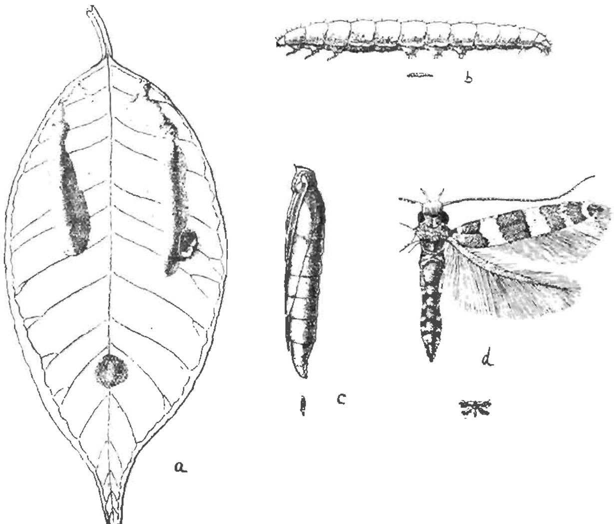
" Bred at Pusa in August from larvæ mining blotches in leaves of *Terminalia catappa* (Combretaceæ), in company with *A. erioplaca* and undistinguished from them "(1).

ACROCERCOPS QUADRIFASCIATA, STT.

Gracilaria quadrifasciata, Stt., T. E. S. (3), I, pt. iii, pp. 295-296, t. 10, f. 5 (1862)(1).
Acrocercops quadrifasciata, Meyr., Exot. Micr., I, 624-625 (1916)(2).

Described from Calcutta where the larvæ were found by Atkinson mining the under side of the leaves of *Urena lobata* and the upper side of the leaves of an unknown plant. Atkinson's description of these larvæ was :—

" Larva mining leaves of *Urena lobata*, 25th May 1856.—Very pale whitish-green, dorsal vessel deep green; head small; jaws light chestnut; legs



Acrocercops phaeospora:—*a*, Leaf of *Eugenia jambolana*, showing larval galleries and cocoons ; *b*, larva (x 10) ; *c*, pupa (x 10) ; *d*, moth (x 10).

concolorous with the body. The larva first detaches the lower cuticle for the full extent of the mine, and then proceeds to devour the parenchyma.

"Larva on . . . . ?, 4th June 1856.—Of a uniform brilliant amber-yellow, transparent, smooth, with slight depressions on the sides of each segment; jaws reddish; the alimentary canal, when full, gives the appearance of a deep green band down the back. The larva at first mines a very irregularly-contorted gallery under the upper cuticle, and whilst engaged in this operation it only consumes the juices which unite the cuticle with the parenchyma. Gradually the greater part or the whole of the surface occupied by this gallery is mined, so as to form one chamber. The upper cuticle becomes wrinkled, and slightly contorts the leaf, so as to form a spacious apartment and the larva proceeds to devour the parenchyma. The leaf is not discoloured but appears blotched with white, from the colourless upper cuticle. When full-grown the larva quits the mine, and forms a compact orange or vermilion coloured cocoon in a depression of a leaf, or any other convenient place. After a few days the pupa thrusts one end through the cocoon, and the moth escapes "([1]).

"The name [*quadrifasciata*, Stt.] must be restricted to the specimens bred from pale green larvæ mining blotches in under side of leaves of *Urena lobata* (Malvaceæ) "([2]).

ACROCERCOPS PROSACTA, MEYR.

Acrocercops prosacta, Meyr., Exot. Micr., II, 175 (1918)([1]).

"Bred at Pusa in August from larva mining blotch in leaf of *Ipomœa batatas* (Convolvulaceæ) "([1]).

Larvæ were collected at Pusa on 26th July 1916 mining leaves of sweet-potato and the moths emerged between 4th and 6th August. No description of the early stages was made. (Ram Saran's Cage-slip, dated 26th July 1916.)

ACROCERCOPS PHÆOSPORA, MEYR. (PLATE XXXVII.)

Acrocercops phæospora, Meyr., Exot. Micr., I, 627 (1916)([1]).

"Bred in August at Belgaum from larva mining a large elongate opaque much swollen blotch in leaf of *Eugenia jambolana* (*Myrtaceæ*); cocoon orange, external. (*Maxwell*) "([1]).

Also reared at Pusa from larvæ found on 16th April 1917 mining green leaves of *Eugenia jambolana,* causing large blister-like swellings on the upper surface. There may be a single blister on either blade or two blisters on the two blades, each blister being of course caused by a single larva. The larva is small and delicate, about 3·5 mm. long, uniform pale yellow, head slightly

brownish. When full-grown the larva leaves the mine and forms a circular flat cocoon on a depressed corner (*e.g.*, by the side of a raised leaf-vein or on the upper side of the midrib) and pupates in it. The larvæ are heavily parasitized by a small black Hymenopterous fly. The moths are on the wing at Pusa throughout May. (Insectary Cage-slip 1572.)

ACROCERCOPS TERMINALIÆ, STT.

Gracilaria terminaliæ, Stainton, T. E. S. (3), I, 298-299, t. 10, f. 8 (1862)([1]).
Acrocercops terminaliæ, Meyr., B. J., XVIII, 817 (1908)([2]).

Described from Calcutta from larvæ mining the under side of the leaves of *Terminalia Catappa*. The larva was described by Atkinson as "small, but very active. It detaches the lower cuticle over a wide extent of surface; it devours both layers of parenchyma, not continuously, but in very small oblong patches, so that the upper surface of the mined portion of the leaf which is blotched with purple, appears thickly sprinkled over with white dots. The lower cuticle, which is detached, is very thin and transparent, and, by slightly contracting, it curves the upper portion of the leaf, so as to form a very spacious vaulted chamber for the little resident. On attaining its full growth, the larva leaves the mine and spins in some convenient corner a compact white cocoon "([1]).

ACROCERCOPS CATHEDRÆA, MEYR.

Acrocercops cathedræa, Meyr., B. J., XVIII, 817 (1908)([1]), *l.c.*, XXIII, 119 (1914)([2]); Fletcher, Entl. Note 84 (1916)([3]).
Acrocercops phalarotis [nomen nudum], Lefroy, Ind. Ins. Life, p. 538 (1909)([4]).

Recorded from the Khasi Hills([1]), Pusa([3, 4]), Kanara([2]), Rajshahi([3]) and Coimbatore([3]).

Larva mining leaves of *Achyranthes aspera*([3 4]).

Larva mining inconspicuous galleries in leaves of "*Kungina*" creeper([2]).

Larva mining leaves of mango at Pusa in August 1908. Also recorded from Rajshahi in March 1911 and Coimbatore (31st May 1913).

Larvæ were found at Pusa mining leaves of *chichira* (*Achyranthes aspera*) on 11th September 1915, as many as nine or ten larvæ in one leaf. The epidermal tissue of both surfaces is attacked and mined into large irregular patches measuring as much as 31 mm. in diameter (average about 22 mm.); the upper surface, where attacked, turns yellow and then brown and the lower surface to brownish-green.

The larva is about 3·5 mm. long and 0·75 mm. broad, yellow, segments distinct; head short with brown cheeks, clypeus and mandibles; hairs on

segments very short, arising from small shiny yellow tubercles; legs short, yellow.

When full-grown the larva quits the mine through a small hole torn in the upper epidermal layer and pupates on the green part of the upper surface of the same leaf in an oval white cocoon about 4 by 2 mm., constructed inside an outer fine irregular brownish covering, measuring about 5 by 2·5 mm. and usually placed in a slightly curved portion of the leaf. (Umrao Bahadur's Cage-slip 66.)

Larvæ were also found at Pusa on 12th September 1916, mining leaves of *Achyranthes aspera* and from these a moth emerged on 22nd September. (Insectary Cage-slip 1492.)

ACROCERCOPS ORTHOSTACTA, MEYR.

Acrocercops orthostacta, Meyr., Exot. Micr., II, 174 (1918)(1).

" Bred at Pusa in August from larvæ mining blotches in leaves of *Sida cordifolia* (Malvaceæ) "(1).

Larvæ were collected mining *bariar* leaves at Pusa on 28th July 1916 and the moths emerged between 4th and 10th August. No description of the early stages was made. (Ram Saran's Cage-slip, dated 28th July 1916.)

Also reared in April 1918 from larvæ mining leaves of *Sida spinosa*.

ACROCERCOPS AUSTEROPA, MEYR.

Acrocercops austeropa, Meyr., B. J., XXIII, 121-122 (1914)(1).

Described from North Kanara(1).

Larva on " Akri "; cocoon very flat, attached to surface of leaf, whitish ochreous, with four scattered bubbles on its surface, apparently similar to those on the cocoon of *Epicephala chalybacma*(1).

This species has been reared at Pusa from larvæ mining leaves of *Bauhinia purpurea* and *B. variegata*.

ACROCERCOPS RESPLENDENS, STT.

Gracilaria resplendens, Stainton, T. E. S. (3), I, 294-295, t. 10, f. 4 (1862)(1).
Acrocercops resplendens, Meyr., B. J., XVIII, 818 (1908)(2), Wytsm. Gen. Ins., fasc. 128, p. 16, tab., ff. 20 a-c (1912)(3).

Originally described from Calcutta(1) and since recorded from the Khasi Hills(2). Common at Pusa, perhaps attached to *Ficus religiosa*, but not yet bred. We have specimens from Pusa, Chapra, Puri and the Khasi Hills.

ACROCERCOPS TRICYMA, MEYR.

Acrocercops tricyma, Meyr., B. J., XVIII, 819-820 (1908)(1).

Described from the Khasi Hills(1) and Pusa(1).

Bred at Pusa in April from larvæ mining leaves of *Blumea lacera*(1).

Larvæ were found at Pusa on 22nd April 1907 mining leaves of *kukraunda* * (*Blumea lacera*), four or five larvæ sometimes found in a single mine. The larva was described as 3 mm. long, rather flattened anteriorly, tapering posteriorly, yellowish-green, head flattened, yellow. Pupation occurred within the mine in a cocoon of very white silk. Pupa 3·5 mm. long, yellow, slender. Moths emerged between 28th April and 5th May. (A. Mujtaba's Cage-slip 21.)

ACROCERCOPS ÆMULA, MEYR.

Acrocercops æmula, Meyr., Exot. Micr., 1, 628 (1916)(1).

Bred at Pusa in February from larvæ mining leaves of *Cynoglossum* (*Boraginaceæ*) (Fletcher)(1). We have it also from Virajpet (South Coorg) and Abbottabad (larva mining *Cynoglossum* leaves).

Larvæ were found at Pusa on 6th February 1914 and 16th December 1915, mining in leaves of *kukraunda* (*Cynoglossum* sp.). As many as four or five larvæ may be present in a single leaf mining in the epidermal layers of the upper surface and feeding on the chlorophyll, the tunnels being situated in the middle of the leaves and not necessarily on the edges only. The larval excrement is deposited in one place within the mine and not in a line, and the mine is not linear but long and broad, although irregular in shape. If the upper epidermis is removed the larva is able to spin another thin webbing over it. The larva is yellow and about 6 mm. long by 0·7 mm. broad; the head is the most highly chitinized portion and is dark brown, mandibles black, antennæ three-jointed, third joint rather pointed and longer than the other two together; legs blackish; three pairs of prolegs and anal claspers; each segment with a single small lateral hair situated near the spiracle; dorsal area smooth, without hairs; nine spiracles, each slightly protruded above the body-surface and tinged with brown.

When full-fed the larva pupates in a silken web spun below the part mined and immediately below the upper whitened epidermis. The moulted skin is attached to the anal end of the pupa within the flattish cocoon. The pupa is about 5 mm. long, yellowish-white, ventral surface flattened, dorsal surface smooth and cylindrical, head portion broadest and abruptly terminated in a point, each segment with very minute single dorsal hairs, segments distinct. From larvæ collected on 6th February 1914 the moths emerged between 16th and 20th February, and from mined leaves collected on 16th December 1915

* Under *A. æmula* the name of *kukraunda* is given as *Cynoglossum* sp. In the case of some of these old records it is impossible to check these identifications, but *A. æmula* has also been reared from *Blumea balsamifera*.

the moths emerged between 23rd December and 3rd January 1916. The larva is parasitized by a yellow Braconid. (Dwarka Prasad Singh's Cage-slip No. 1 and C. S. Misra's Cage-slip of 16th December 1915.)

This species has also been reared at Pusa from larvæ collected on 21st December 1916 and found mining just under the epidermal layer on the upper surface of leaves of *Blumea balsamifera*. The mine was in the form of a blister extending on both sides of the midrib. These larvæ pupated in cocoons formed within the mine and the moths emerged between 2nd and 11th January 1917. (Pusa Insectary Cage-slip 1506.)

ACROCERCOPS ISONOMA, MEYR.

Acrocercops isonoma, Meyr., Exot. Micr., I, 625 (1916)(1); Fletcher, Entl. Note 84 (1916)(2).

Bred at Pusa in May from larva mining in leaf of *Mangifera indica* (1, 2).

ACROCERCOPS ISODELTA, MEYR.

Acrocercops isodelta, Meyr., B. J., XVIII, 820 (1908)(1), *l.c.*, XXIII, 119 (1914)(2).

Recorded from Maskeliya, in Ceylon(1), and from Karwar, in North Kanara(2).

Larva mining blotches in leaves of *Colebrookea oppositifolia* (Labiatæ)(2).

ACROCERCOPS GEMONIELLA, STT.

Gracilaria gemoniella, Stainton, T. E. S. (3) I, 297, t. 10, f. 6 (1862)(1).

Acrocercops gemoniella, Meyr., B. J., XXIII, 120 (1914)(2), Exot. Micr., I, 628 (1916)(3).

Originally described from Calcutta(1), this species has been bred at Karwar, in North Kanara, from larvæ mining blotches in leaves of sugarcane (*Saccharum officinarum*); pupa in external oval brownish-yellow cocoon in depression on surface of leaf (*Maxwell*)(2).

"Bred from green larvæ mining large blotches in leaf of *Semecarpus Anacardium* (Anacardiaceæ), several larvæ in one blotch; cocoon external, cream-coloured. (*Maxwell*.) The same species was previously sent by Mr. Maxwell as bred from sugarcane, but it would seem probable that there must have been some error in that record"(3).

This species was bred at Pusa in January 1915 from a larva mining a leaf of *Achras sapota*.

ACROCERCOPS BARRINGTONIELLA, DEV.

Gracilaria barringtoniella, van Deventer, Tijds. voor Ent., XLVII, 14-17, t. 1, ff. 5, 5^a, 5^b (1908)(1).

Acrocercops barringtoniella, Meyr., B. J., XXIII, 121 (1914)(2).

Originally described from Java(1). Within our limits recorded from North Kanara(2).

Larva mines in young leaves of *Barringtonia spicata*(1) and also mines blotches in leaves of *Careya arborea* (*Lecythidaceæ*)(2).

ACROCERCOPS LYSIBATHRA, MEYR.

Acrocercops lysibathra, Meyr., Exot. Micr., I, 626-627 (1916)(1).

Originally described from Pusa, this species has been bred at Pusa from a larva mining "*bhagandhra*" leaf. (A. Mujtaba's Cage-slip 24.)

It has also been reared from larvæ collected at Pusa on 17th March 1916 mining leaves of *lasora* (*Cordia latifolia*). The larva eats the upper epidermal tissue, the veins of the leaf being left untouched, and forms an irregular blister-like mine white around the margins and brown in the centre, as many as four larvæ being present in a single leaf. The larva was described as 5 mm. long and about 1 mm. broad, slightly flattened, segments distinct, yellow with a greenish middorsal stripe on abdominal segments; head small, flattened, brown; thoracic segments broadest, prothorax brownish; legs short, yellow; only four pairs of prolegs, concolorous with the body. Pupation takes place outside of the mine. The moth is on the wing from March to May. (Ram Saran's Cage-slip, dated 17th March 1916.)

ACROCERCOPS PHRACTOPA, MEYR.

Acrocercops phractopa, Meyr., Exot. Micr., II, 177 (1918)(1).

"Bred at Pusa in April from larvæ mining blotches in leaves of *Ficus infectoria*"(1).

ACROCERCOPS GEOMETRA, MEYR.

Acrocercops geometra, Meyr., Exot. Micr., I, 626 (1916)(1).

Described from Pusa and Coimbatore(1).

Larva mining blotch in leaf of *Cordia myxa* (*Boraginaceæ*) (Fletcher)(1). This species was also bred at Coimbatore from larvæ mining *Cordia* leaves.

Larvæ were found at Pusa on 11th July 1908, and were described as about 5 mm. long, flattened, tapering posteriorly, red, head very small and armed with a flat yellow cap, prothorax yellowish-red; legs creamy, prolegs red. The larva mines in the leaves of the foodplant and pupates externally

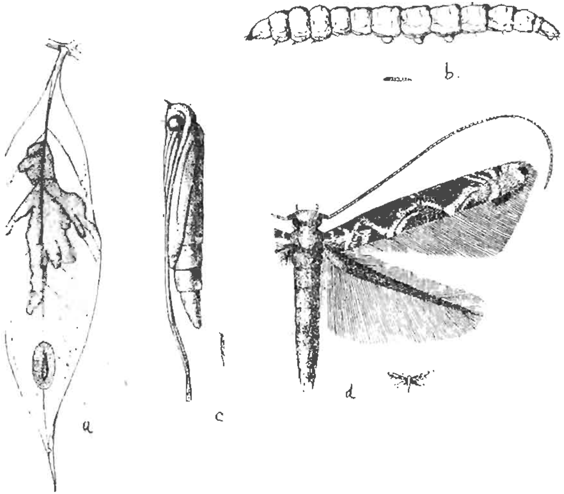


Fig. 1. *Acrocercops hierocosma*:—*a*, mined litchi leaf (natural size), showing larval gallery and cocoon; *b*, larva (x 10); *c*, pupa (x 10); *d*, moth (x 10).

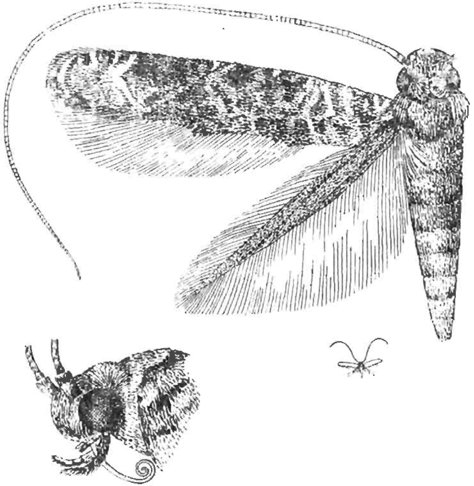


Fig. 2. *Acrocercops auricilla*: —Moth, natural size and magnified.
Below is seen a side-view of head of moth, more highly magnified.

in a double-walled cocoon. Pupa rather less than 4 mm. long, brown, wings dark-brown; pupal period five days. (A. Mujtaba's Cage-slip 43.)

ACROCERCOPS HYPHANTICA, MEYR.

Acrocercops hyphantica, Meyr., Exot. Micr., I, 25 (1912)(1).

Described from specimens reared at Pusa(1).

Larva flattened, slightly tapering posteriorly, yellowish-green, head whitish-yellow; mining leaves of *Cæsalpinia bonducella* (*Leguminosæ*); pupa in a cocoon outside the mine(1).

Pupa about 4 mm. long, head and anal segment yellow, wings yellowish-green, remainder green. Pupal period four or five days. Pupa emerges half way out of the cocoon. (A. Mujtaba's Cage-slip 56.)

ACROCERCOPS HIEROCOSMA, MEYR. (PLATE XXXVIII, FIG. 1.)

Acrocercops hierocosma, Meyr., Wytsm. Gen. Ins., fasc. 128, p. 18 (1912)(1); Fletcher, Entl. Note 86 (1916)(2), Ann. Rept. Impl. Entom., 1917-18, p. 104 (1918)(3).

Originally described from North Australia, this species has been reared at Pusa from a larva mining leaves of *Nephelium litchi*(2). In August 1917 quite appreciable damage was done at Pusa to the tender leaves of *Nephelium litchi* by the mining of this larva(3).

The larva first of all bores into the midrib which develops a dusky red colour; it begins somewhere near the base of the leaf and works towards the apex. As it goes forward it mines the blade of the leaf on both sides of the midrib, along the veins, producing a characteristic palmate dusky-red mine, as the entire mined portion develops a dusky-red colour. In bad cases of attack the whole leaf dries up.

The full-grown larva is about 5 mm. long and about 0·75 mm. across the anterior part of the body which tapers slightly posteriorly, segments distinct, uniform green, fourth pair of prolegs absent.

When full-fed, the larva leaves the mine and forms a round scale-like flat cocoon on the leaf or stem wherever a suitable cover or concavity is available. In confinement cocoons were formed in the corners of the cage or by the side of the protuberant midrib of the leaf. The cocoon is almost transparent, so that the contained pupa is partly visible.

The pupa is slender, cylindrical, about 4·3 mm. from head to anal extremity, beyond which the extremity of the leg-case extends for another 1·5 mm. and about 0·75 mm. broad, frons with a curved spine with which the pupa pierces the cocoon; colour green at first, afterwards turning yellow-brown.

On emergence, the pupa protrudes from the cocoon to some extent. Pupal period about seven days. (Insectary Cage-slips 1299, 1653.)

The moths are found at Pusa from August to October.

ACROCERCOPS AURICILLA, STAINT. (PLATE XXXVIII, FIG. 2.)

Gracilaria ? auricilla, Stt., T. E. S. (2), V, 120-121 (1859)(1).
Acrocercops cramerella (*nec* Snell.), Meyr., Exot. Micr., II, 4 (1916)(2).

Described originally from "near Calcutta"(1). "Reared at Belgachia, Bengal, in September from larvæ mining in leaves of mahogany, *Swietenia* (Meliaceæ)"(2). We have it also from Pusa.

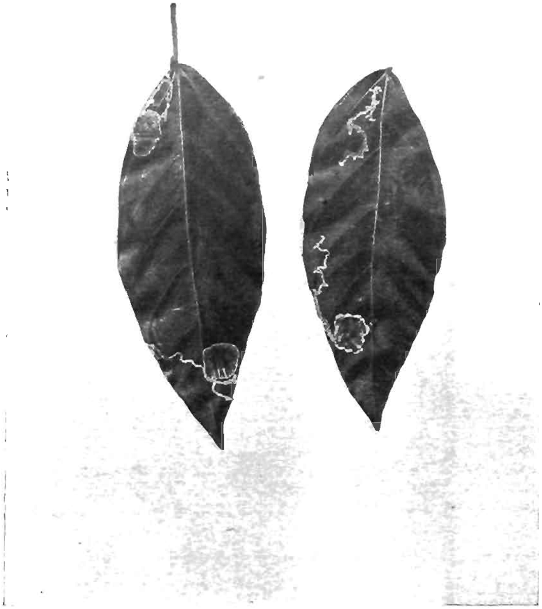
Specimens of affected mahogany leaves were received in the beginning of September 1915 from the Principal of the Veterinary College, Belgachia, who stated that the leaves were mined and that the trees looked in bad condition as a consequence. The leaves were tunnelled on both surfaces by mines which at first are long and narrow (not exceeding 0·5 mm.) and irregular but which expand into oval whitish blotches, averaging about 11 by 7 mm. When the leaf is mined at its edges the mined portion becomes papery, turns deep brick-red, and withers. The edges of the outer cover are thickened until there is made an elongate space sufficient to contain the pupa. In some cases the whitish blotches containing the pupæ touch or coalesce with one another.

The pupa is about 7 mm. long and 1 mm. broad; head brown with a ventral triangular structure with dentate sides, eye-cap large, antenna-case brownish-yellow, reaching to first abdominal segment and spotted irregularly with black; first pair of legs short, reaching to end of thoracic region; second pair of legs reaching to anal extremity; third pair of legs projecting 1·5 mm. beyond anal extremity; thoracic region dorsally with short brown hairs arising from small rounded raised tubercles; thoracic segments yellowish-brown; abdominal segments pale, tinged with green and with short brown hairs on small rounded raised tubercles, spiracles distinct and appear like rounded brown holes at the anterior end of each segment.

ACROCERCOPS TELESTIS, MEYR.

Acrocercops telestis, Meyr., E. M. M., XLVII, 213 (Sept. 1911)(1); Lefroy, Ind. Ins. Life, p. 538 (1909)(2); Fletcher, Entl. Note 87 (1916)(3).

Described from specimens reared at Pusa from larvæ mining leaves of *Trewia nudiflora* (Euphorbiaceæ)(1, 2). Also reared at Coimbatore in February 1913 from larvæ on *Trewia*, and at Pusa in August 1907 from *Gmelina arborea*



Leaves of *Ficus glomerata* mined by *Acrocercops desiccata.*

and in September 1913 from leaves of *Eugenia jambolana*(3). We also have this species from Moulmein.

Larvæ were found at Pusa on 24th July 1907 mining leaves of *pitha* (*Trewia nudiflora*). The larva was described as 3 mm. long, rather flattened, tapering posteriorly, yellow, head pale; afterwards 4·5 mm. long, green; only four pairs of prolegs. Pupated externally on upper or underside of leaves or in corners of the cage, cocoon of very fine white silken threads. Pupa 4 mm. long, green, last two abdominal segments yellowish. Pupa protrudes about half its length from cocoon on emergence of moth; pupal period about five days. (A. Majtaba's Cage-slip 25.)

Larvæ were also collected at Pusa mining leaves of *Eugenia jambolana* on 1st September 1913 and from these leaves moths emerged from 6th to 9th September. The larval mine forms a prominent blister-like blotch, inside which the larva moves freely about between the epidermal layers, filling the space with excrement. When removed from the mine the larva is unable to enter another leaf unless the epidermis is opened up artificially. (Dwarka Prasad Singh's Cage-slip, dated 1st September 1913.)

ACROCERCOPS DESICCATA, MEYR. (PLATE XXXIX.)

Acrocercops desiccata, Meyr., Exot. Micr., II, 4 (1916)(1).

Described from Peradeniya and Pusa. At Pusa it was bred from larvæ mining blotches in leaves of *Ficus glomerata*(1).

The larva mines just below the epidermis on the upper surface of the leaf. The mine commences as a zigzag white line, quite prominent on the green leaf, and develops suddenly into a blotch. The full-grown larva is about 3·5 mm. long, flattened, gradually tapering posteriorly, segments distinct, three pairs of thoracic legs and five [?] pairs of prolegs functional although small; colour light green when young, changing to golden-yellow and ultimately to reddish before pupation. When full-fed the larva almost always leaves the mine and pupates elsewhere in a flattish cocoon formed of well-woven silk and having a very thin almost transparent parchment-like appearance. Each cocoon is double, there being a small inner case inside a larger outer case. The cocoon is usually constructed in a corner or small concavity. Before emergence of the moth, the pupa wriggles out of the cocoon for about half its length, the empty pupa-case being left protruding from the cocoon. Larvæ were collected in *Ficus glomerata* leaves on 23rd December 1914; one formed a cocoon on 24th December and emerged on 20th January and another pupated on 5th January and emerged on 24th January 1915. (Pusa Insectary Cage-slip 1148.)

ACROCERCOPS USTULATELLA, STT.

Gracilaria ? *ustulatella*, Stainton, T. E. S. (n.s.), V, 121-122 (1859)(1).
Conopomorpha isochorda, Meyr., B. J., XVII, 746 (1907)(2).
Acrocercops ustulatella, Meyr., B. J., XVIII, 825 (1908)(3).

Originally described from Calcutta(1). Also recorded from Peradeniya(2). Larva mines in young leaves of ebony(2).

ACROCERCOPS SYNGRAMMA, MEYR. (PLATE XL, FIG. 1.)

Acrocercops syngramma, Meyr., B. J., XXIII, 120 (1914)(1); Fletcher, Entl. Note 84 (1916)(2).

Described from Karwar in North Kanara(1), where it was bred in July from larva mining a compact blotch in leaves of mango (*Mangifera indica*); pupa in a detached oval brownish-yellow cocoon on surface of leaf (*Maxwell*)(1).

Reared at Pusa in September 1907 and again in August 1908 from larvæ mining mango leaves. Also taken at Bankipur in October 1911(2). We have it also from Pusa in September to November 1916, from Saidapet in January 1907 and from Coimbatore in December 1914 and March 1915, in all cases reared from larvæ mining mango leaves.

The larva mines under the epidermis on the upper surface of tender mango leaves, causing large round or roundish blisters which are greyish-white in colour. The larva is about 5 mm. long and about 0·7 mm. across the thoracic region, cylindrical (or almost so), tapering posteriorly, segments well-defined and rather prominent laterally, pale greenish-yellow, the dark contents of alimentary canal partially visible through the body; head brownish-yellow, shiny, smaller than prothorax, which has a faint shiny yellowish shield; a faint whitish tracheal line along the spiracular region; primary hairs short; legs and prolegs concolorous with body; prolegs on third, fourth, fifth abdominal and on anal segment. From leaves collected on 25th September moths emerged from 4th October to 1st December 1916, and from leaves collected on 2nd November 1916 moths emerged on 15th and 16th November. (Insectary Cage-slip 1478 and Ram Saran's Cage-slip, dated 2nd November 1916.)

ACROCERCOPS LABYRINTHICA, MEYR.

Acrocercops labyrinthica, Meyr., Exot. Micr., II, 177-178 (1918)(1).

"Bred at Pusa in March and April from larvæ mining blotches in leaves of *Trema* sp. (Urticaceæ)"(1).

Larvæ were collected at Pusa on 16th March 1916 mining the upper surface of leaves of *Trema* sp. The larva was described as 5 mm. long by

PLATE XI.

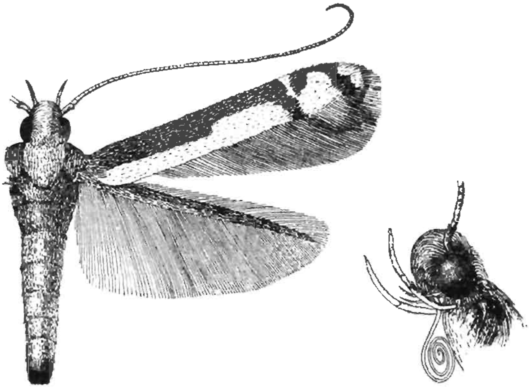


Fig. 1. *Acrocercops syngramma*:—Moth, magnified (x 16). Below is seen a side-view of head of moth, more highly magnified.

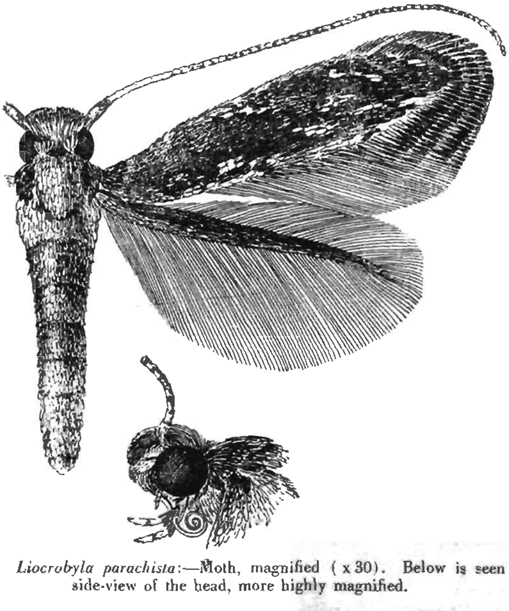


Fig. 2. *Liocrobyla parachista*:—Moth, magnified (x 30). Below is seen a side-view of the head, more highly magnified.

1 mm. broad, flattened, dark green, yellowish laterally, segments distinct; head small, brown; thoracic segments broadest; prothoracic shield represented by two blackish dots; only four pairs of prolegs. Pupation occurs outside of the mine, in a white cocoon usually on the upper surface of the leaf near the midrib. The moth is on the wing in March and April and probably later. (Dwarka Prasad Singh's Cage-slip, dated 16th March 1916, and Ram Saran's Cage-slip, dated 3rd April 1916.)

ACROCERCOPS ALLACTOPA, MEYR.

Acrocercops allactopa, Meyr., Exot. Micr., I, 627 (1916)(1).

Bred at Karwar, in North Kanara, in July and August from larvæ mining swollen blotches in leaves of *Eugenia jambolana* (*Myrtaceæ*), several larvæ in one blotch; cocoon external (*Maxwell*)(1).

ACROCERCOPS BIFRENIS, MEYR.

Acrocercops bifrenis, Meyr., Exot. Micr., II, 176 (1918)(1).

"Bred at Khanapur, Belgaum, from larvæ mining numerous blotches in leaves of two unidentified plants, January, February. Larva when young light red, tapering posteriorly, when full-grown bright crimson and cylindrical; blotch irregular, often confluent, each with an irregular roundish rent in the cuticle whilst still occupied by the larva; pupa outside the mine, in an oval orange cocoon; imago quivers on its legs like *vanula* (*Maxwell*). Closely allied to *vanula*; as that species feeds on *Terminalia* (Combretaceæ), it is not improbable that the foodplants of this are of the same order "(1).

ACROCERCOPS BROCHOGRAMMA, MEYR.

Acrocercops brochogramma, Meyr., Exot. Micr., I, 285 (1914)(1).

Described from Peradeniya, where it was bred in June from leaves of *Hibiscus* sp. containing galls of a Phytoptid(1).

ACROCERCOPS CRYSTALLOPA, MEYR.

Acrocercops crystallopa, Meyr., Exot. Micr., I, 627-628 (1916)(1).

Bred at Karwar, in North Kanara, in July and August from larvæ mining somewhat circular blotches in leaves of *Memecylon amplexicaule* (*Melastomaceæ*), larva cylindrical with lateral prominences, emitting single rather long hairs; pupa internal in blotch, without cocoon (*Maxwell*)(1).

ACROCERCOPS CYLICOTA, MEYR.

Acrocercops cylicota, Meyr., B. J., XXIII, 119 (1914)(1).

Described from Karwar in North Kanara(1).

Larva mining blotches in leaves of *Colebrookea oppositifolia* (*Labiatæ*); pupa in cocoon in folded edge of leaf (*Maxwell*)(1).

ACROCERCOPS DIATONICA, MEYR.

Acrocercops diatonica, Meyr., Exot. Micr., I, 625-626 (1916)(1).

"Bred at Shirve, in North Kanara, in December from larvæ mining light blister-like blotches on upper side of leaves of an unidentified plant, occupying whole leaf; cocoon yellowish, within mine (*Maxwell*)"(1).

ACROCERCOPS ELAPHOPA, MEYR.

Acrocercops elaphopa, Meyr., B. J., XXIII, 121 (1914)(1).

Reared at Karwar, in North Kanara, in July from external cocoon on depressed vein of surface of leaf of "Total" creeper(1).

ACROCERCOPS ERIOPLACA, MEYR.

Acrocercops erioplaca, Meyr., Exot. Micr., II, 175 (1918)(1).

"Bred at Pusa in August from larvæ mining blotches in leaves of *Terminalia catappa* (Combretaceæ)"(1).

ACROCERCOPS EXTENUATA, MEYR.

Acrocercops extenuata, Meyr., Exot. Micr., I, 624 (1916)(1).

"Bred at Karwar, in North Kanara, in July from larvæ mining blotches on under surface of leaves of unidentified shrub, several blotches in a leaf separated by main veins (*Maxwell*)"(1).

ACROCERCOPS HEMIGLYPTA, MEYR.

Acrocercops hemiglypta, Meyr., Exot. Micr., II, 1 (1916)(1).

Described from Karwar, in North Kanara, where it was "bred in August from larvæ mining round blotches in leaves of an unidentified plant, cocoon external, white (*Maxwell*)"(1).

ACROCERCOPS LOXIAS, MEYR.

Acrocercops loxias, Meyr., Exot. Micr., II, 174 (1918)(1).

"Bred at Jodhpur, Rajputana, in June from *Eugenia jambolana* (Myrtaceæ), (*Beeson*)"(1).

ACROCERCOPS MACROCLINA, MEYR.

Acrocercops macroclina, Meyr., Exot. Micr., II, 2 (1916)(1).

Described from Karwar, in North Kanara, where it was "bred in August from larvæ mining blotches on upper side of leaves of *Wagatea spicata* (*Leguminosæ*), occupying whole leaf; cocoon external, white (*Maxwell*)"(1).

ACROCERCOPS PHAROPEDA, MEYR.

Acrocercops pharopeda, Meyr., Exot. Micr., I, 626 (1916)([1]).

"Bred at Karwar, in North Kanara, in July from larva mining small semi-transparent blotch in leaf of unidentified creeper; cocoon brownish-yellow, detached (*Maxwell*)"([1]).

ACROCERCOPS SCANDALOTA, MEYR.

Acrocercops scandalota, Meyr., B. J., XXIII, 120 (1914)([1]), Exot. Micr., I, 628 (1916)([2]).

Described from North Coorg([1]).

"Bred in North Kanara from larva mining blotch in leaf of *Helicteres isora* (Sterculiaceæ) (*Maxwell*)"([2]).

ACROCERCOPS SCENIAS, MEYR.

Acrocercops scenias, Meyr., B. J., XXIII, 122 (1914)([1]).

Described from Karwar, in North Kanara([1]), where it was bred in June from a bright green larva mining galleries in leaves of "*Changana*" bush, many larvæ in each leaf; pupa long, green, in oval white transparent cocoon on depressed vein of leaf (*Maxwell*)"([1]).

ACROCERCOPS SCRIPTULATA, MEYR.

Acrocercops scriptulata, Meyr., Exot. Micr., II, 2-3 (1916)([1]).

Described from Karwar in North Kanara, where it was "bred in July from unusually large irregularly elongate oval semi-transparent white cocoons, with three or four small attached bubbles, found on surface of leaf, each on a vein, scattered about on various sorts of bushes in neighbourhood of *Terminalia paniculata* (Combretaceæ), which is probably the foodplant; at considerable distances apart, indicating a wandering habit before pupating (*Maxwell*)"([1]).

ACROCERCOPS TENERA, MEYR.

Acrocercops tenera, Meyr., Exot. Micr., I, 284-285 (1914)([1]).

Bred at Peradeniya from larva mining leaves of *Schleichera trijuga*"([1]).

ACROCERCOPS TRISCALMA, MEYR.

Acrocercops triscalma, Meyr., Exot. Micr., II, 1 (1916)([1]).

Described from Karwar, in North Kanara, where it was "bred in August and September from larvæ mining blotches on upper side of leaves of *Wagatea spicata* (Leguminosæ), occupying whole leaf; cocoon external, white (*Maxwell*)"([1]).

ACROCERCOPS VANULA, MEYR.

Acrocercops vanula, Meyr., Wytsm. Gen. Ins. fasc., 128, p. 17 (1912)(1), B. J., XXIII, 121 (1914)(2).

Described from Karwar, in North Kanara(1).

"Larva mining large blotches in leaves of *Terminalia tomentosa* (Combretaceæ); pupa yellowish, in large oval cream-coloured cocoon spun usually on vein inside the mine, the cuticle subsequently peeling off and leaving the cocoon exposed; this seems the normal arrangement, but in captivity the larva sometimes makes an external cocoon in a recess on surface of leaf (*Maxwell*)"(2). Mr. Maxwell (*in litt.*) gives the name of the foodplant as *T. paniculata*.

LIOCROBYLA PARASCHISTA, MEYR. (PLATE XL, FIG. 2.)

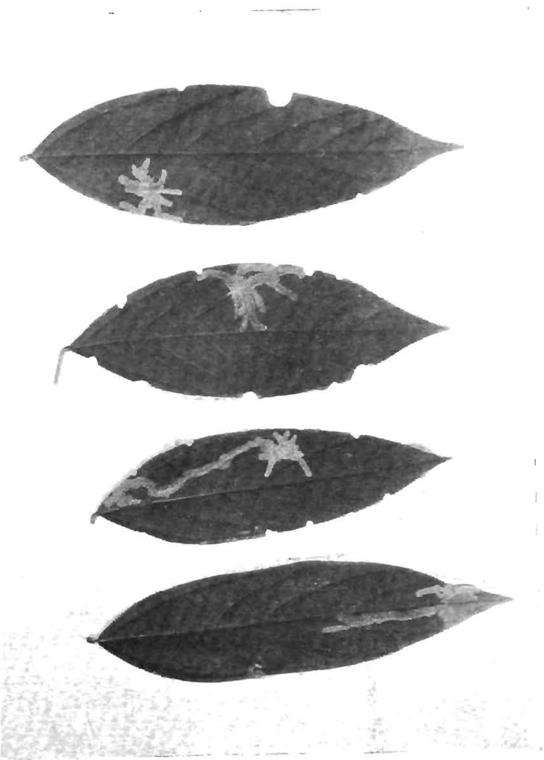
Liocrobyla paraschista, Meyr., Exot. Micr., II, 5 (Oct. 1916)(1).
Parectopa labrodes, Meyr. MS. (*ined.*)

Reared at Manchikeri, North Kanara, "in May from larvæ mining in leaves of *Butea frondosa* (Leguminosæ) (*Maxwell*), and at Pusa in February from larvæ mining in leaves of *Cajanus indicus* (*Fletcher*); it may therefore probably feed in some other Leguminosæ. Larva mines a blotch beneath upper cuticle of leaf, building up two heaps of excrement, between which the larva rests in a covered passage leading obliquely to under side of leaf, where a small open door exists in a dry opaque patch; cocoon external, oval (*Maxwell*)"(1).

This species has been reared at Pusa on several occasions from larvæ mining leaves of *Cajanus indicus* in April, September, October and December, and from leaves of *Desmodium gangeticum* in January and July.

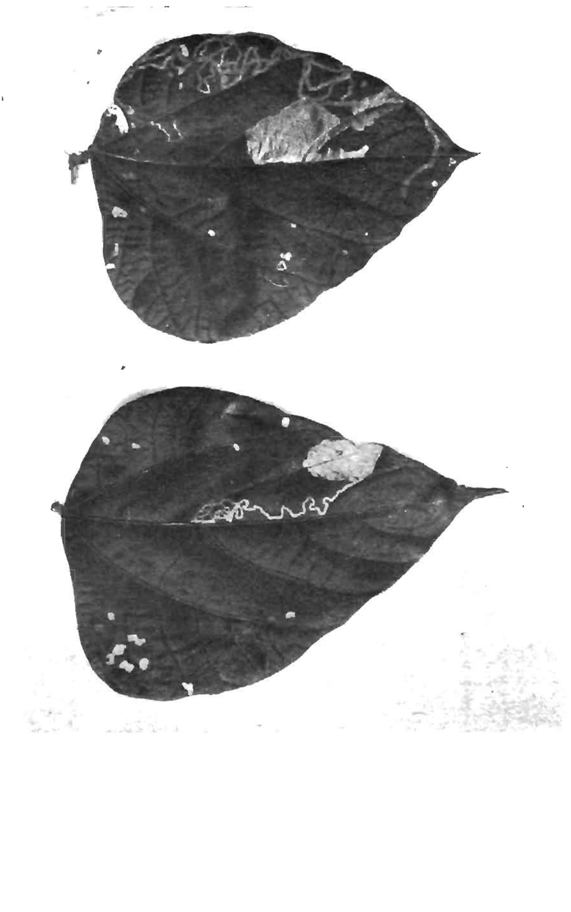
The larva mines just under the epidermal layer of either surface, but in the case of *Cajanus* usually the upper surface of the leaf, producing an extremely irregular brown patch measuring about one square inch in total area. (Plate XLI.) In the case of mines in *Desmodium* leaves the greater portion of the mine is not visible from the opposite side of the leaf; a small portion only, where the mesophyll tissue also has been eaten, is visible from the opposite surface as a dry brown patch. The larva thrusts its anal extremity through a hole in the lower surface of the mine to eject its frass and the gallery is therefore kept clean. The larva is green, broadest across the thoracic portion, tapering posteriorly, segments distinct; head long, brown; only four pairs of prolegs. The larva leaves the mine before pupation and forms a white cocoon, about 6 mm. long, on the surface of the leaf in any convenient corner, often alongside a midrib on the upper surface of a leaf,

PLATE XLI.



Leaves of *Cajanus indicus* mined by *Liocrobyla parachista*

PLATE XLII.



Leaves of *Dolichos lablab* mined by *Cyphosticha coerulea*.

The dark-brown pupa protrudes from the cocoon on emergence of the moth. (Insectary Cage-slip 1430 and Umrao Bahadur's Cage-slip 112.)

STOMPHASTIS PLECTICA, MEYR.

Stomphastis plectica, Meyr., Wytsm. Gen. Ins. fasc., 128, p. 19, tab., ff. 1, 26 (1912)(1), B. J., XXIII, 122 (1914)(2).

Originally described from Karwar, in North Kanara(1). Also recorded from South Africa(2). We have it from Bankura, Pusa and Surandi (Tinnevelly District).

" Larva mining blotches in leaves of *Sebastiana chamælea* (Euphorbiaceæ); pupa in detached oval white cocoon in depression on top of leaf, preferring the extreme tip (*Maxwell*) "(2). Mr. Maxwell (*in litt.*) describes the larva as stout, tapering posteriorly ; head small, fuscous, body green.

This species has been reared from larvæ found at Bankura on 16th July 1917, mining leaves of *Jatropha gossypifolia* (Euphorbiaceæ), one or several larvæ being found in one leaf, and at Pusa from larvæ mining " *bhagendra* " leaf. Larva pale greenish-yellow, head brown, no prolegs on sixth abdominal segment. When full-grown it leaves the mine and forms a flattened whitish papery silken cocoon on any depression on the leaf or in any suitable corner. The pupa wriggles out of the cocoon on emergence of the moth. (Insectary Cage-slip 1609.)

The Tinnevelly specimens are labelled " from wild castor leaves " ; presumably *Jatropha* is intended.

PARECTOPA COCCINEA, WLSM.

Gracilaria coccinea, Wlsm., in Swinh. Cat. Het. Oxf. Mus., II, 576 (1900)(1).
Macarostola coccinea, Meyr., B. J., XVIII, 827 (1908)(2).

Described from Ootacamund where the larva is a leaf-roller on myrtle(1).

CYPHOSTICHA CŒRULEA, MEYR.

Cyphosticha cœrulea, Meyr., Exot. Micr., I, 26 (1912)(1) ; Proc. Second Entl. Meeting, pp. 42, 56 (1917)(2).

Described from Pusa(1), but probably widely distributed in the Plains as we have it from Coimbatore also.

" Larva somewhat flattened, slightly tapering posteriorly, greenish, laterally pale yellow, with subdorsal reddish dot on each segment, head flat ; when full-grown, becomes wholly blood-red : mining a whitish elongate blotch in leaves of *Crotalaria juncea* (Leguminosæ) or a brownish blotch in leaves of *Vigna sinensis* (Leguminosæ) "(1).

Occurs commonly at Pusa and Coimbatore, mining in leaves of *Cajanus indicus*(2) and *Dolichos lablab*(3).

This species has been found at Pusa on numerous occasions, mining the leaves of *Dolichos lablab*, *Vicia faba*, *Phaseolus mungo*, and *Vigna catjang* from April to October. The larva mines the upper surface of the leaf, feeding just below the epidermal layer which turns brown or brownish-white. The mine starts as a narrow irregular line but later on widens into a broad blotch which shows up prominently on the leaf. (Plate XLII.) The larva is about 4 or 5 mm. long, rather flattened, segments sharply defined and slightly protruding laterally, tapering posteriorly from thoracic region, uniform reddish-brown, the green contents of the alimentary canal visible along the length of the body, and with a red submedian stripe; head flattened, smaller than prothorax, light brown; legs and prolegs well developed, reddish-brown; prolegs only on third to fifth abdominal segments, together with the anal claspers. When full-fed, the larva emerges from the mine and pupates in a white silken cocoon afforded by the folding of any portion or by the side of a protruding leaf-vein. The pupa wriggles out through one end of the cocoon before the moth emerges and the empty pupa-case is left protruding from the cocoon. The pupa is about 3·5 mm. long, pale yellow, eyes red, wings and last two abdominal segments whitish-yellow. (Insectary Cage-slip 903, Dwarka Prasad Singh's Cage-slips, dated 9th May 1914 and 16th April 1916, and Ram Saran's Cage slips, dated 17th and 25th April 1916.)

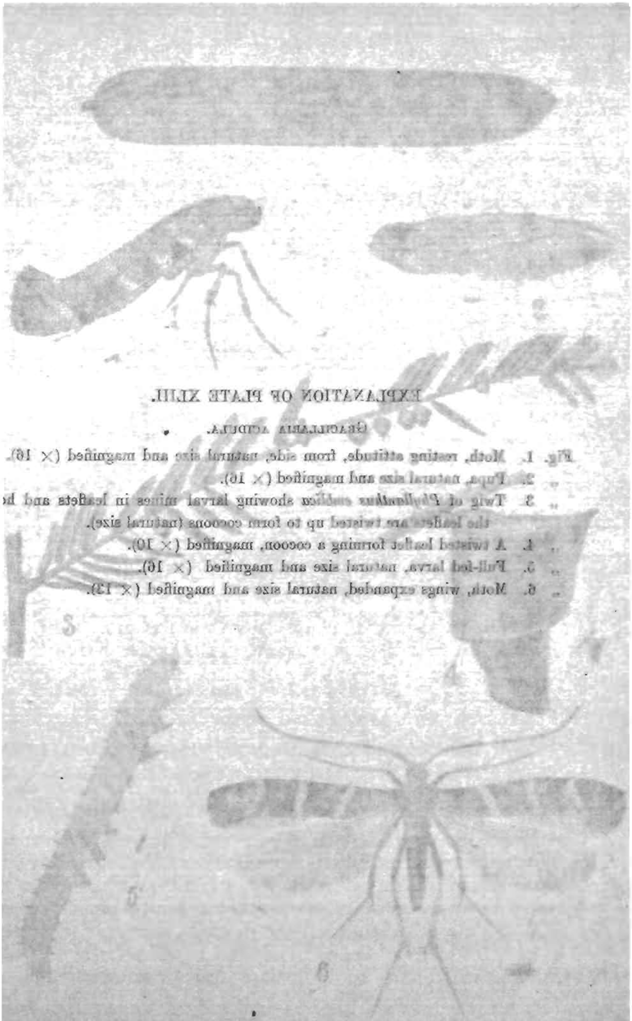
GRACILLARIA ACIDULA, MEYR. (PLATE XLIII.)

Acrocercops acidula, Meyr., E. M. M., XLVII, 213 (Sept. 1911)(1).

Gracilaria acidula, Meyr., Exot. Micr., I, 26 (1912)(2), *id.*, *l.c.*, II, 178 (1912)(3).

Described from Pusa(1). Larva on *Albizzia stipulata* (Leguminosæ)(1). "Mr. Fletcher informs me that the larva mines leaves of *Phyllanthus emblica* (Euphorbiaceæ), not of *Albizzia* as originally stated through a mistaken identification of a native name "(3).

This species is abundant at Pusa, the larvæ mining in the leaflets of compound leaves of *amlak* (*Phyllanthus emblica*). The larva mines a part or a whole of a leaflet, usually on the under surface but also on the upper surface of the leaf, which turns pale brown or deep brown where mined. The mine usually commences near the apex of a leaflet as a narrow sinuous line which expands into an elongate blotch towards the base of the leaflet. (Plate XLIII, fig. 7.) The upper epidermis is completely separated from the lower, the intervening space being filled with blackish pellets of excrement. The



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EXPLANATION OF PLATE XLIII.

GRACILLARIA ACIDULA.

Fig. 1. Moth, resting attitude, from side, natural size and magnified (× 16).

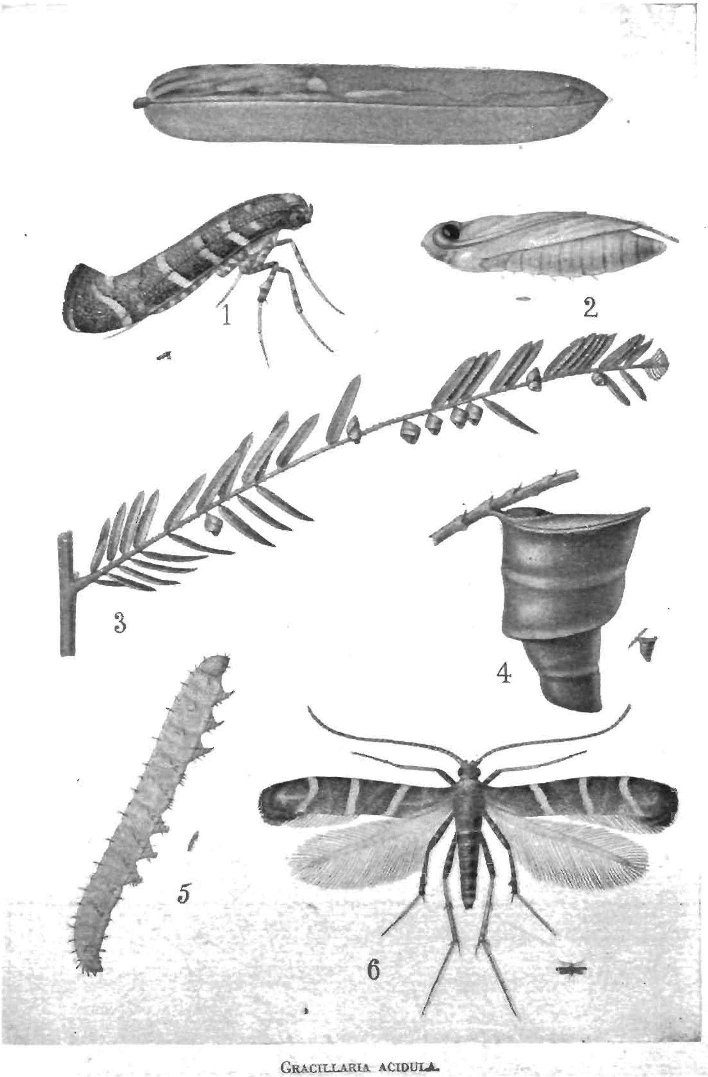
,, 2. Pupa, natural size and magnified (× 16).

,, 3. Twig of *Phyllanthus emblica* showing larval mines in leaflets and how the leaflets are twisted up to form cocoons (natural size).

,, 4. A twisted leaflet forming a cocoon, magnified (× 10).

,, 5. Full-fed larva, natural size and magnified (× 16).

,, 6. Moth, wings expanded, natural size and magnified (× 13).



GRACILLARIA ACIDULA.

Fig. 1. Details of larva of *Gracillaria acidula*: *a*. Head, from above, magnified (×67); *b*, head, from below, magnified (×67); *c*, antenna, highly magnified (×333); *d*, mesothoracic leg, right side, magnified (×67).

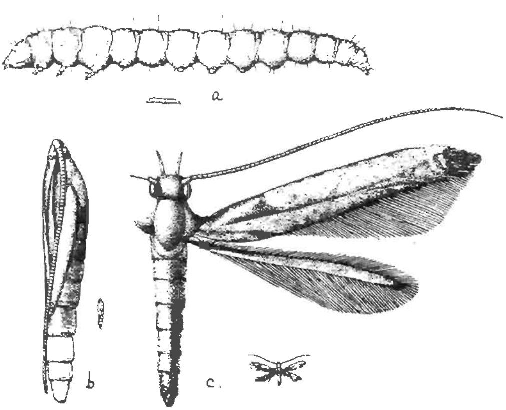


Fig. 2. *Gracillaria zachrysa*:—*a*. Larva, natural size and magnified (×11) (from a spirit specimen); *b*, pupa; *c*, moth, natural size and magnified (×11).

larvæ are able to leave their mines freely and, if a branch is disturbed, almost all the larvæ leave their mines and walk about.

The larva is about 3 mm. long, cylindrical, very slightly tapering posteriorly, segments distinct, yellow, with thin scattered hairs ; head rounded, yellow ; prolegs only on third to fifth abdominal segments, together with the anal claspers. (Plate XLIII, fig. 5.)

When full-fed the larva leaves the mine through a round hole bitten through the upper epidermis and twists another green leaflet into a cone to form a pupal chamber. It first of all turns up the tip of the leaflet and fixes its apex to one side of the upper surface of the leaf with silken threads ; it then bites three or four small holes near the edge of the leaflet near the rolled-up apex and a few more holes about one millimeter nearer the base and proceeds gradually to bend and twist the leaflet until the whole of it is rolled-up into a cone. (Plate XLIII, fig. 4.) Many of these cones may be formed close together and look like a row of small fruits hanging from the rachis. (Plate XLIII, fig. 3.) Inside the cone a thin white silken cocoon is formed and inside this the larva pupates.

The pupa is about 2·5 to 3 mm. long, cylindrical, yellow. (Plate XLIII, fig. 2.) In some examples the antenna-case projects beyond the anal extremity, in others it barely projects. The pupa wriggles out of the cocoon to some extent before the moth emerges.

The moth rests in the usual Gracillariad manner and waves its antennæ about briskly. (Plate XLIII, fig. 1.) It occurs at Pusa from March to June and probably throughout the year.

GRACILLARIA OCTOPUNCTATA, TURNER.

Gracilaria octopunctata; Turner, Tr. Roy. Soc. S. Austral., 1894, 123(1) ; Meyr., Pr. Linn. Soc. N. S. W., 1907, 65(2), B. J., XVIII, 828 (1908)(3), Rec. Ind. Mus., V, 227(4), Tr. N. Z. Inst., 1909, 73(5); *l.c.*, XLVII, 228 (1915)(6) ; Lefroy, Ind. Ins. Life, p. 538 (1909)(7).

Originally described from Australia, where it is recorded from Queensland(2, 6). Also known to occur in the Kermadec Islands(5, 6) and in Africa(6). Within our limits it has been recorded from Pusa(3), the Khasi Hills(3), Darjiling(4), and North Coorg(3). We have it from Pusa, Lebong (Darjiling), and Bassein Fort (Bombay).

The larva rolls the small leaves of *Dalbergia sissu*, forming a small mass of often dry leaves in which it lives and pupates. The pupa is sometimes in a web of very white glistening silk on a leaflet(7).

At Pusa it has been reared from a pupa found on *Polygonum* [? accidental pupation-place] and from larvæ found on 14th August 1906 rolling leaves of *Dalbergia sissu* (*Leguminosæ*). Sometimes several leaves are joined together and these masses of leaves are found to be dry and rotten. The larva was described as 6 mm. long, flattened, very slightly tapering posteriorly, yellowish-green; head pale, prothorax with many small black spots. Pupation takes place in a rolled leaf, the pupa being 5·5 mm. long, brown. The pupal period is about six days. (A. Mujtaba's Cage-slip 8.)

GRACILLARIA ZACHRYSA, MEYR. (PLATE XLIV, FIG. 2.)

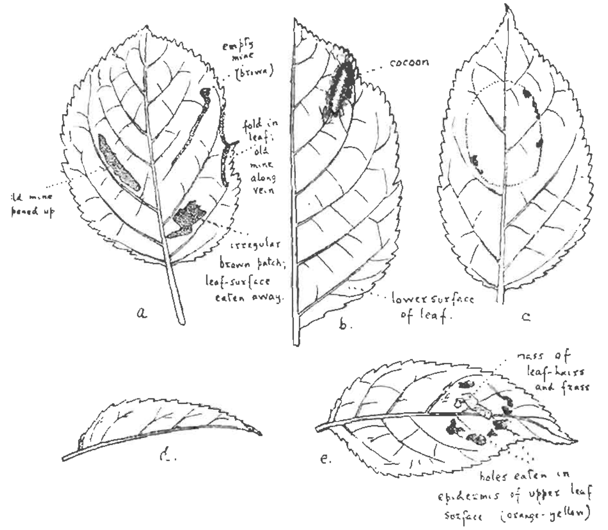
Gracilaria zachrysa, Meyr., B. J., XVII, 983 (1907)(1), *l.c.*, XVIII, 829 (1908)(2), Wytsm., Gen. Ins. fasc., 128, p. 29, tab., f. 4 (1912)(3); Meyr., Exot. Micr., II, 179 (1918)(4); [*nec* Busck, *Insec. Inscit. Menstr.*, III, 42-43 (1915) = *azaleella*, Brants].

Originally described from Maskeliya in Ceylon(1). "Recently bred in India from larvæ making cones on leaves of apple (*Pyrus malus*) (*Fletcher*). Hence I was led to discover that *azaleella*, Brants (=*azaleæ*, Busck), bred from *Azolea indica* imported from Japan into Europe and North America, and probably a native of Japan, is really quite distinct from *zachrysa*, and I was mistaken in asserting the contrary"(4).

This species probably occurs throughout the apple-growing districts of Northern India, the larva feeding on young leaves of apple and being at times a considerable pest. We have it from Parachinar, Peshawar and Abbottabad and from Shillong, and I have seen attacked apple-leaves at Ramgarh (*Kumaon*).

In its early stages the larva mines the leaf, but later on it leaves the mine and folds, or more rarely rolls, a young leaf. The attack is first noticeable as a rusty-yellow irregular blotch on the under side of a leaf. The enclosed larva is not visible on holding the leaf up to the light but on opening up the blotch it is found as a pale greenish-yellow or greenish-white larva with very strongly-defined segments, tapering anally. The larva mines on the lower surface of the leaf, often several in one leaf, sometimes as many as four or five. The gallery proceeds along and parallel with the interior (*i.e.*, nearest to the midrib) side of a vein, apparently starting at the inner end and working outwards. When fresh, the mine is green and inconspicuous, slightly shiny like a snail-track; it is filled with leaf-hairs and usually contains frass at the outer end. Later on, the larva bites a hole through the upper surface of the mine and leaves it. Apparently after the larva has left (? due to growth of the leaf) the mine usually forms a puckered fold in the leaf-surface. At one

PLATE XLV.



ple leaves showing damage by larva of *Gracillaria zachrysa*:—*a*. leaf showing mines, fold, and patch eaten. *b*. Lower surface of leaf showing cocoon. *c*, older leaf with young larva. Leaf opened out. The portion sewn together (upper surface) marked with dotted line. Portions of epidermis of leaf nibbled by larva (whitish), marked in black. *d*. Young leaf. Edges sewn together longitudinally. *e*. Half-grown leaf containing larva, completely folded along edges, opened up, showing method of feeding of larva.

end of the mine the upper surface of the leaf turns rusty-yellow; otherwise the mine is only visible from above by the fold in the leaf. Sometimes, when near the edge of a leaf, the edge is folded over to form a sort of trough in which the mine lies; it is not possible to say whether this is done deliberately by the larva or whether it is caused by the natural growth of the leaf. After leaving the mine, the larva ties up a young leaf longitudinally, the edges of the leaf being joined together over the upper surface on which the larva feeds in its bag-like shelter, nibbling patches out of the epidermis of the leaf, the attacked portions turning rust-coloured. The leaf-hairs are detached and piled in a mass which is often mingled with frass to form a long roll and this is characteristic of the attack even when the leaf contains no larva, which is apparently often eaten by spiders and birds. More rarely, the larva makes a shelter by turning over a portion of the edge of a leaf. The adult larva is unicolorous, pale green or yellowish-green, segments less distinct than in the younger (mining) stage and it does not taper anally so perceptibly.

The larva leaves the leaf to pupate in an elongate-oval cocoon of white silk in which the pupa is dimly visible. In captivity the cocoon is spun in any convenient angle and under natural conditions it has been found on the lower surface of a leaf, where it was placed in a slight fold formed by drawing the leaf together to form a trough, the edges of the trough being kept in place by white cross-threads.

GRACILLARIA THEIVORA, WLSM.

Gracilaria theivora, Wlsm., Ind. Mus. Notes, II, 49 (1891)([1]); Watt and Mann, Tea Pests, pp. 228-232, ff. 23-25 (1903)([2]); Meyr., B. J., XVIII, 829 (1908)([3]); Lefroy, Ind. Ins. Life, p. 538 (1909)([4]).

Described from Pundaluoya in Ceylon([1]), where it has also been found at Madulsima([3]) and Maskeliya([3]). Lefroy([4]) states that it occurs in India also. Watt and Mann also record it from Assam, Darjiling and the Kangra Valley([2]) and we have it from Lebong and Margherita.

The larva feeds upon tea (*Camellia theifera*).

"The egg is deposited near the midrib and on the under surface of the leaf. On hatching, the minute caterpillar is at first a leaf-miner. It eats along, in a somewhat tortuous course, towards the margin. It then escapes and then becomes a leaf-roller, and subsequently causes the margin of the leaf, for half an inch to an inch in length and perhaps less than one-eighth of an inch in breadth, to turn over itself. Within that enclosure it commences to eat the epidermis of the enclosed portion. Shortly after, however, it migrates to a fresh leaf and now commences its more vigorous action. The

overturned margin dies, and gives to the leaf a withered, discoloured and torn appearance. . . . . . The insect in fact, during its larval existence, repeatedly changes its house and thus destroys a large number of leaves" . . . . . .Larva minute, yellowish-white, about 13 mm. long, with prolegs only on third to fifth abdominal segments, with the anal claspers. The larva carefully sews "up the leaf as it rolls it round and when the conch-shell-like structure, thus formed, has been completely wound up and firmly bound together at both ends, the caterpillar proceeds to eat the leaf from the tip downwards. As it progresses, the excretory matter is carefully packed on one side, and partitioned off by a fold of the margin of the leaf brought down for that purpose. When the contained portions of the leaf have been devoured, the operation of winding up the leaf still further is renewed. Coil after coil is made, but usually not more than half the leaf is eaten. The insect then migrates and commences once more to roll a leaf around itself". "When mature, the caterpillar spins a small silken cocoon about one-quarter of an inch long and little more than one-sixteenth in breadth. This will be found within depressions of the leaf or under the lee of a midrib. It opens by a circular mouth to allow of the escape of the perfect insect"(2). [This last point would seem to require verification.]

GRACILLARIA SOYELLA, DEV.

Gracilaria soyella, van Deventer, Tijds. voor Ent., XLVII, 22-25, t. 2, ff. 1, 1*a* (1904)(1).

Gracilaria acrotherma, Meyr., B. J., XVIII, 830 (1908)(2).

Gracilaria soyella, Fletcher, Entl. Note 88 (1916)(3); Proc. Second Entl. Meeting, p. 42 (1917)(4).

Originally described from Java(1), this species has also been recorded from Colombo(2) and Hakgala(2), in Ceylon. It is probably common throughout the Plains of India, as it occurs freely at Pusa(3) and Coimbatore(3) on *Cajanus indicus*(4) and has also been reared at Pusa from *Phaseolus mungo*.

Larva in leaves of *Soya hispida* in Java(1), on *Cajanus indicus* and *Atylosia candollei* in Ceylon(2). It is said to mine the leaves of *Cajanus indicus* in Ceylon(2), but this is probably an error, as in India the larva has been noted on this plant both at Pusa and Coimbatore and found to roll up the tip of the leaf, each end of the chamber so formed being fastened down with silk. The larva turns over the apex of the leaf, usually on to the under surface, and fastens it down with silk and doubles and redoubles the fold until it has made a shelter within which it lives and feeds on the epidermis of the leaf, the interior of the cone being filled with excrement. The larva is about 6 mm.

long, slender, cylindrical, uniformly pale yellow in colour, with only four pairs of prolegs. Many larvæ are parasitized by a small Chalcidid. Pupation may take place within the cone or outside of it in any suitable depression on a leaf, within a yellowish-white silken cocoon to which the pupa is attached by four processes on the anal end of the pupa. Pupa about 5 mm. long and about 1 mm. broad across thoracic region, each segment furnished dorsally with two transverse rows, on anterior and posterior margins, of spinous hairs, those of anterior row thicker and more distinct; similar rows of hairs are present also on the ventral surface but are much fainter. The pupal period is about eight days in February and six or seven days in June. This seems to occur throughout the year at Pusa on *Cajanus indicus* and *Phaseolus mungo*. (Pusa Insectary Cage-slips 646 and 1409.)

GRACILLARIA ISELÆA, MEYR.

Gracilaria iselæa, Meyr., Exot. Micr., I, 286 (1914)(1).

Described from Peradeniya, where it was bred in April from larvæ on *Spondias mangiferæ*(1).

GRACILLARIA ? ? COFFEIFOLIELLA, NIETN.

Gracilaria coffeifoliella, Nietner, Obs. on Enemies of Coffee-tree in Ceylon, p. 24 (1861)(1); *l.c.*, p. 16 (1880)(2); Moore, Lep. Ceylon, III, 525 (1887)(3); Koningsberger, Med. Plant. Java, XLIV, 2 (1901)(4); Meyr., B. J., XVIII, 832 (1908)(5).

Originally described from Ceylon(1); also recorded from Java(4).

Larva said to be common as a leaf-miner in coffee, but the identity of the species concerned is very doubtful(5).

Mines are commonly found in coffee leaves in all the coffee-growing districts in Southern India, but I have never been able to breed any moths out of them, and most of those examined have contained Dipterous larvæ.

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LIFE-HISTORIES OF INDIAN INSECTS
MICROLEPIDOPTERA

VII. EPERMENIADÆ, PLUTELLIDÆ AND LYONETIADÆ

BY

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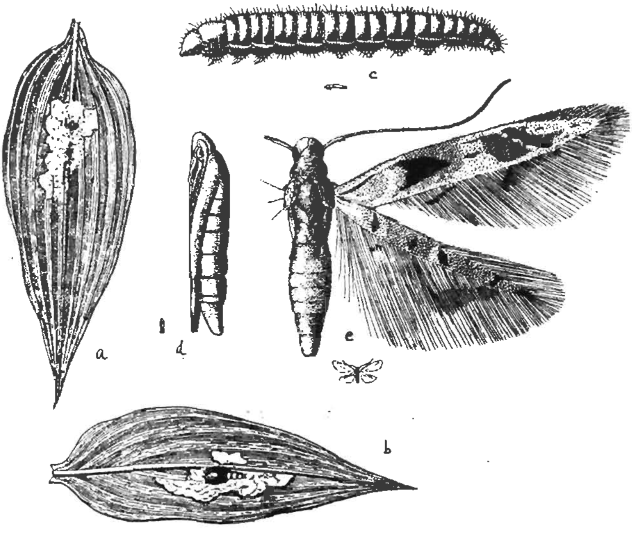

Idioglossa triacma:—*a*, Leaf of *Commelina bengalensis* showing larval mine ; *b*, leaf of *Commelina bengalensis* showing tunnel through which larva moves from one side of the leaf to the other ; *c*. larva, natural size and magnified (x 13) ; *d*, pupa, natural size and magnified (x 13) ; *e*, moth, natural size and magnified (x 13).

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VII. EPERMENIADÆ, PLUTELLIDÆ AND LYONETIADÆ.

BY

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EPERMENIADÆ

EPIMARPTIS PHILOCOMA, MEYR.

Epimarptis philocoma, Meyr., B. J., XXII, 776 (1914)(1), Exot. Micr., II, 69 (1917)(2).

Described from Karwar, North Kanara, from a single specimen reared in September(1). Since recorded from the Khasi Hills(2).

" Larva reddish (including head); lives in a white web on midrib of an unknown plant, the web being on both sides of the leaf, kept off the surface by little pillars of excrement; the webs on either surface of the leaf are connected by holes through the leaf itself, and the larva uses these alternative abodes as a means of escaping observation, dodging through the holes with much agility; cocoon separate, close to midrib, oval, resembling a bird-dropping "(1).

IDIOGLOSSA TRIACMA, MEYR. (PLATE XLVI.)

Idioglossa triacma, Meyr., Exot. Micr., I, 77-78 (1913)(1).

Originally described from the Khasi Hills, this species has been reared at Pusa from larvæ found on 14th November 1916 nibbling leaves of *Commelina bengalensis* (Commelinaceæ). The larva forms a tunnel across the midrib of the leaf and through this tunnel it has access to both halves of the blade of the leaf. It feeds on one epidermis and tissue of the leaf, leaving the other epidermis entire and, over the part it feeds on, it spins a white silken webbing.

so that it can live and feed hidden under this webbing. (Figs. *a*, *b*.) The larva is about 4 mm. long and about 0·75 mm. broad, cylindrical, creamy white; head yellow, shiny, somewhat retractile into prothorax; prothorax with an indistinctly chitinized integument; prolegs minute, five pairs present. The moths emerged between 24th November 1916 and 15th February 1917.

AMPHITHERIDÆ.

This family has been established by Mr. Meyrick (*Exotic Micr.*, I, 154; Dec. 1913), to contain a small group of species developed from the *Plutellidæ*. The only Indian genera are *Agriothera* and *Telethera*, whose early stages are unknown.

PLUTELLIDÆ.

ACROLEPIA MANGANEUTIS, MEYR. (PLATE XLVII, FIG. 1.)

Acrolepia manganeutis, Meyr., Exot. Micr., I, 149(1913)(1); Fletcher, Entl. Note 90, f. 17 (1916)(2), Proc. Second Entl. Meeting, p. 297 (1917)(3).

Described from Calcutta, the Khasi Hills, and Ceylon (Maskeliya)(1). Also from Ootacamund(2).

Larva on stored yams (*Dioscorea*) in Calcutta(1, 2). Pupa in net-work cocoon.

PLUTELLA MACULIPENNIS, CURT.

Cerostoma maculipennis, Curtis, Brit. Entom., IX, t. 420, expl., p. 2 (1832)(1).

Plutella cruciferarum, Zeller, Stett. Ent. Zeit., IV, 281-283 (1843)(2); Quanjer, Tijds. voor Ent., 1906, pp. 11-17, t. 1-2(3).

Plutella maculipennis, Wlsm., Fauna Hawaii, I, 652-653 (1907)(4); Lefroy, Ind. Ins. Pests, p. 152, ff. 170-171(5), Ent. Mem. Agri. Dept. India, I, 225, f. 69(6), Ind. Ins. Life, p. 538, f. 345(7); Meyrick, Rec. Ind. Mus., V, 229(8), Catal. Plutell, p. 59 (1914)(9); Fletcher, S. Ind. Ins., p. 464, f. 340 (1914)(10), Proc. Second Entl. Meeting, pp, 276, 277, 280, 282, 283 (1917)(11).

This cosmopolitan species occurs throughout the world everywhere that man plants cabbages. It is abundant throughout our limits.

The eggs are laid singly on leaves. The full-grown caterpillar is about 8 mm. long, moderately stout, attenuated at each extremity, smooth, with short scattered bristly hairs; in colour pale-green with a pale-brown head and prothoracic shield. Pupa in a slight silken cocoon of open net-like texture; pupal period about ten days. On cabbage, cauliflower, radish, mustard and other cruciferous plants, the larva eating holes in the leaf(10).

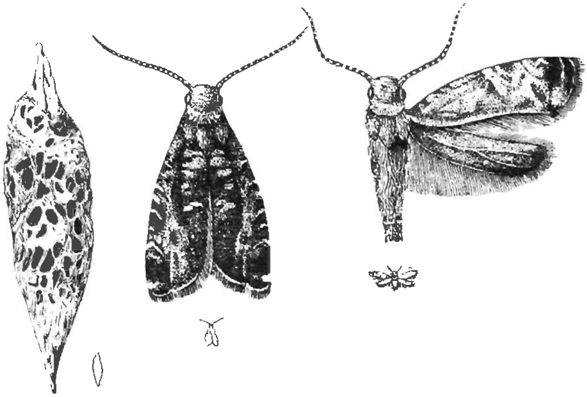


Fig. 1. *Acrolepia manganeutis*:—(The outline figures show the natural sizes.)

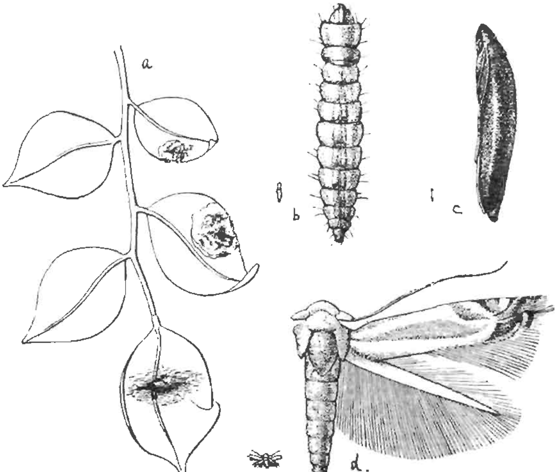
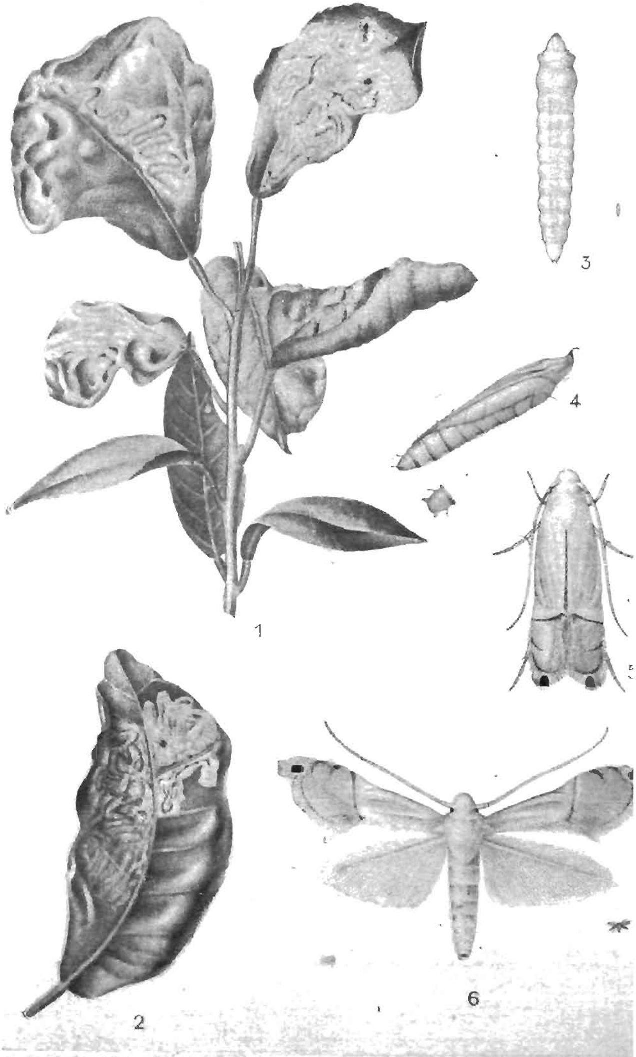


Fig. 2. *Leucoptera sphenograpta*:—*a*, Twig of *Dalbergia sissu* showing larval mines in leaves and cocoon on terminal leaf ; *b*, larva ; *c*, pupa ; *d*, moth, natural size and magnified (x 13).



PHYLLOCNISTIS CITRELLA.

EXPLANATION OF PLATE XLVIII.

PHYLLOCNISTIS CITRELLA.

Fig. 1. Twig of *Citrus* with leaves mined by larvæ, natural size.

„ 2. Leaf of *Citrus*, mined by larvæ. On right-hand side the larva is seen in the mine. On left-hand side, near tip of leaf, the edge is bent over to form a cocoon for pupation of the larva which has quitted the mine (natural size).

„ 3. Larva, natural size and magnified (× 17).

„ 4. Pupa, natural size and magnified (× 17), from side. A dorsal view of posterior extremity of pupa is also shown.

„ 5. Moth, position at rest, natural size and magnified (× 17).

„ 6. Moth, wings expanded, natural size and magnified (× 17).

LYONETIADÆ.

LEUCOPTERA SPHENOGRAPTA, MEYR. (PLATE XLVII, FIG. 2.)

Leucoptera sphenograpta, Meyr., B. J., XXI, 108-109 (1911)(1); Lefroy, Ind. Ins. Life, p. 539 (1909)(2).

Described from Multan(1) and Pusa(1). We have it from Pusa, Peshawar, Lyallpur and Asansol; doubtless it occurs throughout the Plains of Northern India wherever *Dalbergia sissu* grows.

Larva mining blotches in leaves of *Dalbergia sissu*(1).

Larva mining leaves of *Dalbergia sissu*, at times extremely destructive to young plants. Moths abundant in the cold weather when the leaves of the *sissu* fall [about February at Pusa]; when new leaves are put forth, they lay their eggs, a single small egg on each leaflet(2).

The larva mines a blotch near the edge of a leaf of *Dalbergia sissu*, practically all the new leaves being affected in some years. When fresh, the mine is not very evident but later on it turns brown and is then conspicuous. The moths are common at Pusa throughout the winter and often occur in countless thousands about the end of April, two months after the new *Dalbergia* leaves have been put forth.

PHYLLOCNISTIS CHRYSOPHTHALMA, MEYR.

Phyllocnistis chrysophthalma, Meyr., Exot. Micr., I, 347-348 (1915)(1).

Described from North Kanara(1). Larva mining blotches in leaves of *Cinnamomum zeylanicum*(1).

PHYLLOCNISTIS CIRRHOPHANES, MEYR.

Phyllocnistis cirrhophanes, Meyr., Exot. Micr., I, 348 (1915)(1).

Reared in North Kanara in May from larvæ mining blotches in leaves of *Alseodaphne semecarpifolia* (*Lauraceæ*)(1).

PHYLLOCNISTIS CITRELLA, STT. (PLATES XLVIII, XLIX.)

Phyllocnistis citrella, Stainton, T. E. S. (n. s.), III, 302-303 (1856)(1); Meyr., Ann. S. Afr. Mus., 1909, 360(2); Fletcher, S. Ind. Ins., pp. 465-466, f. 341 (1914)(3); Rutherford, Trop. Agric., XLIII, 49-50 (July 1914)(4); Proc. Second Entl. Meeting, pp. 209, 210, 216 (1917)(5).

Originally described from Calcutta(1), this species occurs throughout India, Ceylon (and Burma ?), and has also been recorded from Cape Colony(2), whither it was doubtless introduced with its foodplant.

The larva feeds on *Citrus* spp., *bael* (*Ægle marmelos*) (Plate XLIX), *Murraya koenigii*, and *bela* (*Jasminum sambac*). In the case of orange, this insect is often a bad pest, especially of young plants, as practically every new leaf may be mined by one or more larvæ. The larvæ also mine under the epidermis of the green stems. The mines are usually found on the upper surface of the leaf and are winding and irregular in shape. The larva works just under the epidermis and feeds on the chlorophyll cells. The larva is about 2·5 mm. long, head and thoracic segments somewhat flattened, abdominal segments cylindrical, segments distinct, stoutest at mesothorax tapering posteriorly almost to a point, uniform pale-yellow or pale-green, naked; head smaller than prothorax, brownish pale green, with prominent antennæ, mandibles and labrum tinged with light brown, ocelli four, black; two lateral black specks on prothorax and mesothorax; legs and five pairs of prolegs very minute and only visible under a lens. The larva moves more by contracting and expanding the body than with the help of the legs and prolegs.

When full-grown, the larva leaves the mine and pupates in a white cocoon, formed on the leaf in any corner afforded by the folding of any part of the leaf (often under a small up-folded portion of the edge of the leaf) or by the side of a raised vein. Before emergence of the moth the pupa is protruded to some extent through one end of the cocoon. (Pusa Insectary Cage-slip 900.)

PHYLLOCNISTIS HABROCHROA, MEYR.

Phyllocnistis habrochroa, Meyr., Exot. Micr., I, 349 (1915)([1]).

Described from N. Kanara, where the larva was found mining leaves of "cheli"([1]).

PHYLLOCNISTIS HELICODES, MEYR. (PLATE L, FIG. 1.)

Phyllocnistis helicodes, Meyr., Exot. Micr., I, 618 (1916)([1]).

Reared at Pusa in November from larvæ mining leaves of *Polyalthia longifolia* (Anonaceæ)([1]).

Larvæ were collected at Pusa on 10th September 1917, mining leaves of *asoka* (*Polyalthia longifolia*). The mine is made just below the epidermis on the upper surface of the tender leaves. An old mine appears as a broad continuous convoluted brown streak with a whitish space on each side, running up and down the length of the leaf or across its breadth over the midrib. The brown white-edged streak constitutes the mine, the brown streak being the dried liquid excrement of the larva which feeds on either side as it proceeds, the whitish space being the dried mined epidermis of the leaf. When the

Bael (*Ægle marmelos*) leaves mined by larvæ of *Phyllocnistis citrella*.

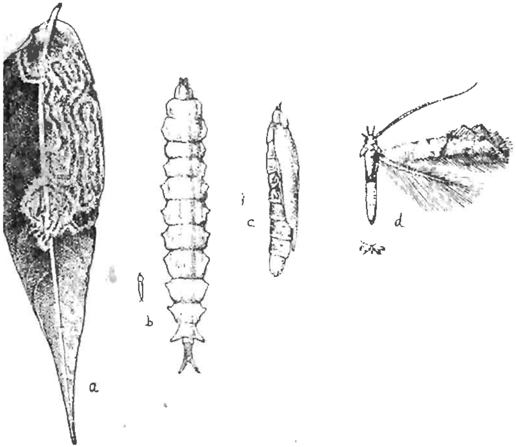


Fig. 1. *Phyllocnistis helicodes*:— *a*, Leaf of *Polyalthia longifolia* mined by larvæ; *b*, larva; *c*, pupa; *d*, moth, natural size and magnified (× 11).

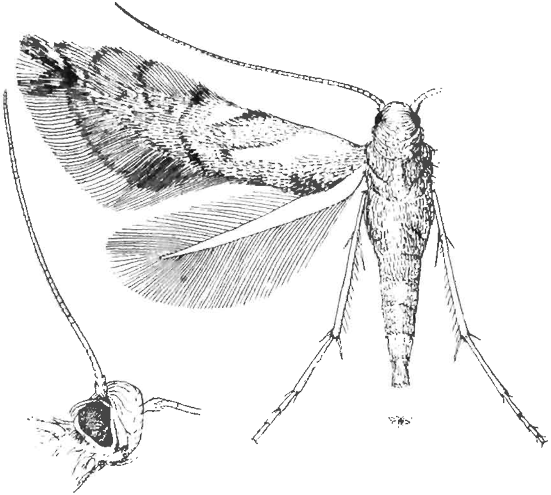


Fig. 2. *Phyllocnistis toparcha*: Moth, natural size and magnified.
Below is seen a side-view of the head of moth, more highly magnified.

larva is full-fed, if it happens to be near the edge of the leaf, it turns over the edge of the leaf and forms a cocoon in which to pupate. If, however, it happens at that time to be somewhere near the middle of the blade, the cocoon is formed there in a sort of depression formed by drawing the contiguous portions of the blade together with silk.

The larva is about 5 mm. long, flattened, segments distinct, uniform pale yellow; head flat, tapering anteriorly, somewhat conical in outline and with two longitudinal furrows; the first eight abdominal segments with a lateral protuberant spine, that on eighth abdominal segment the longest; ninth and tenth abdominal segments tubular, the tenth elongated and bifurcated posteriorly into two long fleshy spines; no legs or prolegs visible (Fig. *b*).

The pupa is about 3 mm. long, cylindrical, tapering slightly posteriorly, light yellow, the dorsal abdominal region blackish; head tapering anteriorly and armed with a narrow black spine bent dorsally; abdominal segments with a dorsal row of black posteriorly-directed short pointed spines; anal extremity rounded and armed on either side with a tubular round-headed process (Fig. *c*).

The moths emerged on 17th September. (Pusa Insectary Cage-slip 1684.)

PHYLLOCNISTIS SELENOPA, MEYR.

Phyllocnistis selenopa, Meyr., Exot. Micr. I, 348-349 (1915)(1).

Bred at Peradeniya from larvæ mining leaves of *Melia azedarach* (1). This is a very minute species, only expanding three millimetres.

PHYLLOCNISTIS SYNGLYPTA, MEYR.

Phyllocnistis synglypta, Meyr., Exot. Micr., II, 183 (1918)(1).

"Bred at Dharwar, N. Kanara, in February from light green larvæ mining galleries in leaves of a small unidentified shrub, pupa internal in folded edge of leaf (*Maxwell*) "(1).

PHYLLOCNISTIS TOPARCHA, MEYR. (PLATE L, FIG. 2.)

Phyllocnistis toparcha, Meyr., Exot. Micr., II, 182 (1918)(1); Proc. Second Entl. Meeting, p. 235 (1917)(2).

"Bred at Coimbatore in February from larvæ mining leaves of grape-vine (*Vitis vinifera*) "(1). Common on vine at Coimbatore mining the leaves much in the same way as *P. citrella* mines in *Citrus*(2).

BEDELLIA SOMNULENTELLA, Z.

Lyonetia somnulentella, Zeller, Isis 1847, 894-895([1]).

Bedellia somnulentella, Wlsm., Fauna Hawaii, I. 723-724, t. 25, f. 28 (1907)([2]).

This species is found practically all over the world, having been recorded from Europe, North America, Peru, Hawaii, Australia, New Zealand and the Transvaal. In India it is known from North Coorg and may be expected to be found to be widely distributed. We have specimens from Peshawar.

The larva mines in *Convolvulus* and *Ipomœa* and may be expected to occur on sweet potato.

CROBYLOPHORA DARICELLA, MEYR.

Crobylophora daricella, Meyr., Proc. Linn. Soc. N. S. W., V. 178 (1880)([1]), T. E. S., 1894, 29([2]), Ann. Transvaal Mus., VI. 41 (1918)([3]).

Crobylophora staterias, Meyr., B. J., XVI, 613 (1905)([4]).

Crobylophora onychotis, Meyr., Exot. Micr., I. 345-346 (1915)([5]).

Originally described from Queensland ([1]) and since recorded from South Africa([3]), Ceylon([4]), Burma([2]) and India([5]), this species is probably originally a native of South Africa and has been distributed artificially with its foodplant, the garden *Plumbago capensis*, in whose leaves the larva forms blister-like patches, several larvæ feeding in one mine. (See Appendix also.)

BUCCULATRIX CRATERACMA, MEYR.

Bucculatrix crateracma, Meyr., Exot. Micr., II, 184 (1918)([1]).

" Bred at Pusa in October and November from larvæ mining leaves of *Bombax* [*malabaricum*] (Bombacaceæ). Pupa with five abdominal segments free, in ribbed rosy-whitish cocoon attached to leaf. If the mining habit of larva is really persistent, it is exceptional in the genus "([1]).

Larvæ were found at Pusa on 25th September 1916 on leaves of *Bombax malabaricum*. The larva feeds on the green substance of the upper surface of the leaf, leaving the lower tissue untouched, and usually commencing to feed in the middle portion of the leaf. The larva is 6 mm. long and 0·75 mm. broad, tapering towards either extremity, segments distinct, dark green, rather transparent ; head smaller than prothorax, transparent, shiny, bilobed, brownish yellow ; thoracic segments yellowish-green, transparent ; abdominal segments transparent so that the internal organs are visible and the contents of the alimentary canal make the body look dark green ; primary hairs black, situated on minute white setæ ; legs shiny transparent yellow ; five pairs of equally developed prolegs. Pupation takes place in a cocoon about 8 mm. long and 1·5 mm. broad, of which a cross-section is a half-circle, the general

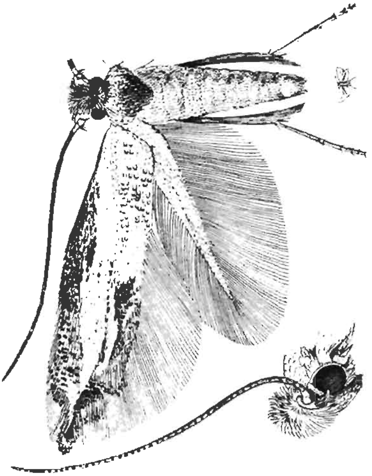


Fig. 1. *Bucculatrix loxoptila*:—Moth, natural size and magnified. Below is seen a side-view of the head of moth, more highly magnified.

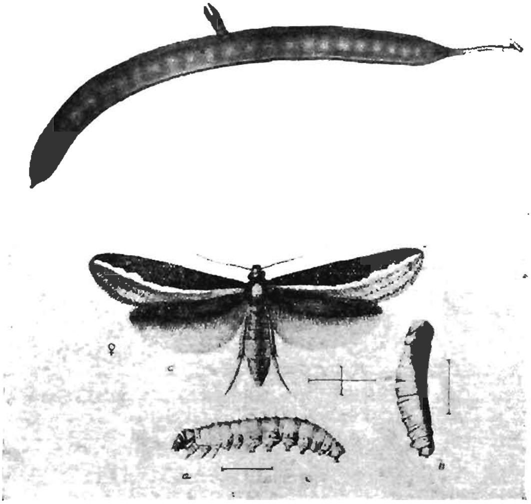


Fig. 2. *Pyloetis mimosae*. (From *Indian Museum Notes*.)

appearance boat-shaped, bulging in the middle, the surface ribbed longitudinally. The cocoon is fixed on a leaf, twig or wall of the cage. The pupa wriggles out of the cocoon before emergence of the moth and the empty pupa-case remains protruded from the cocoon. Moths emerged from 4th October to 18th November. (Pusa Insectary Cage-slip 1477.)

BUCCULATRIX EXEDRA, MEYR.

Bucculatrix exedra, Meyr., Exot. Micr., I, 354-355 (1915)([1]).

Originally described from the Khasi Hills([1]) and North Coorg([1]), this species has been bred at Pusa on 5th June 1911 from a pupa enclosed in a slight silken hammock-shaped cocoon, but no cage-slip or record of foodplant is traceable.

We have specimens from Pusa, Shillong and Pollibetta (Coorg).

BUCCULATRIX LOXOPTILA, MEYR. (PLATE LI, FIG. 1.)

Bucculatrix loxoptila, Meyr., Exot. Micr., I, 209 (July 1914)([1]).

Originally described from Zanzibar, where it was "bred from larvæ on cotton (*Gossypium*)"([1]). This is presumably the leaf-miner of cotton referred to by Aders (*Zanzibar Protectorate, Economic Zoology Report* for 1913, p. 86) under the name *Gelechia* sp.; Aders says:—"Throughout the season all experimental cotton was much infested. The leaves in many instances being covered with concentric tunnels. The young larva is white with a brown thoracic shield measuring 1½ mm.; later it becomes pink, being a conspicuous object beneath the epidermis; average measurement 3 to 4 mm. Pupation takes place on the dorsal side of leaf in an oval silken case. Pupal stage averages five days."

In India this species is known to occur at Attur, Madras Presidency, where it was reared in June 1907 from larvæ "eating small holes in leaf of Caravonica cotton." (Y. Ramachandra Rao; C. No. 170.)

BUCCULATRIX MENDAX, MEYR.

Bucculatrix mendax, Meyr., Exot. Micr., II, 185 (1918)([1]).

"Bred at Pusa in March from pupa in white ribbed elongate cocoon on leaf of *Dalbergia sissu* (Leguminosæ)"([1]).

BUCCULATRIX VERAX, MEYR.

Bucculatrix verax, Meyr., Exot. Micr., II, 184 (1918)([1]).

"Bred at Pusa in March from larva feeding externally on leaf of *Trewia nudiflora* (Euphorbiaceæ)"([1]).

Larvæ were found at Pusa on 12th March 1916 eating holes in leaves of *Trewia nudiflora*, feeding on one side of the epidermal and mesophyll tissue. The larva is about 4 mm. long and 0·75 mm. broad, cylindrical, tapering slightly towards either extremity, segments distinct, pale greyish green; head much smaller than prothorax, pale yellowish with a slight green tinge; prothorax with a horny plate; short scattered pale greenish hairs on segments; five pairs of prolegs. Pupation takes place in a thin white silken cocoon attached to leaves or the sides of the cage. The pupal period is five or six days in March. (Tahl Ram's Cage-slip 156.)

PETASOBATHRA SIRINA, MEYR.

Petasobathra sirina, Meyr., Exot. Micr., I, 355 (1915)(1); Fletcher, Entl. Note 91 (1916)(2).

Described from Gorakhpur and Dalsing Serai in Bihar(1, 2).

Larva on top-shoots of indigo. "The larva is about 4·5 mm. long and about 0·75 mm. across the middle of the body which tapers towards each extremity; the segments are distinctly separated by deep constrictions; shape flattened; head flat, yellow, somewhat elongate, smaller than prothorax; colour uniform dirty white; thoracic legs and five pairs of prolegs greyish.

"The larva covers the top-shoots with a profuse web of fine white silk under cover of which it lives and nibbles small portions of the leaf-surface. It is often seen to walk over the webbing. When full-fed it spins a pure-white somewhat elongated cocoon in any suitable situation which provides some corner, *e.g.*, along the midrib on the upper surface of a leaf or in a rolled or folded leaflet. The moth emerges after about a week and rests with the anterior half of the body well raised and the antennæ held extended at right angles to the body "(2).

OPOGONA CHALINOTA, MEYR.

Opogona chalinota, Meyr., Rec. Ind. Mus., V, 230 (1910)(1); Lefroy, Ind. Ins. Life, p. 540 (1909)(2).

Described from Colombo, Puri in Orissa, and Pusa(1).

Bred at Pusa in March from larvæ feeding in dry stems of *Polypodium quercifolium*(1). Larvæ found in January, reducing the stems to a mass of frass and dust amongst which the full-grown larvæ pupate in white silken cocoons, covered with frass and dust. Moths emerged from 1st January to 11th March(2).

Larvæ were found at Pusa on 23rd January 1907 in a dry *gurur* (*Polypodium quercifolium*) stem, almost the whole interior of the stem having been reduced to dust in which the larvæ lived and pupated. The larva was described as about 10 mm. long, slender, cylindrical, dirty white with small scattered hairs; head red-brown, bilobed; prothoracic shield brownish, skin rather transparent, the blackish internal organs visible through; five pairs of prolegs. Pupation in a white silken cocoon covered with dust and excrement. Pupa rather over 4 mm. long, brown, posterior portion of leg-cases separate and extending to anal extremity. The pupa wriggles out of the cocoon to some extent on emergence of the moth. (Pusa Insectary Cage-slip 501.)

This species has also been bred at Coimbatore from a larva found in bark of *Papaya carica.*

OPOGONA FLAVOFASCIATA, STT.

Lozostoma flavofasciata, Stainton, T. E. S. (n. s.) V, 124 (1859)(1).
Opogona flavofasciata, Petch, Ann. R. B. G. Peradeniya, III, 229 (1906)(2);
Meyr., Rec. Ind. Mus., V, 230 (1910)(3).

Originally described from Calcutta(1,3), this species has been recorded from Peradeniya(2) and is found abundantly at Coimbatore. We have it from the Anamalais (3,600 feet), Coimbatore, Rangoon and Mandalay.

Larva in fungus-combs of termites' nests, which they reduce to a mass of excrementitious matter in a few days when cultures of combs are attempted, the cultures being resolved into a mass of black pellets. Though the moths are apparently confined to this habitat, it is remarkable that no trace of the larvæ or their work has been observed in the termites' nest under natural conditions(2).

OPOGONA PRÆCINCTA, MEYR.

Opogona præcincta, Meyr., Exot. Micr., I, 620 (1916)(1).

"Found at Coimbatore under a log associated with the termite *Odontotermes feæ* (*Fletcher*)"(1). A single specimen was found on 29th July 1912. It is probable that the larva feeds in the nests of *O. feæ*.

OPOGONA LACHANITIS, MEYR.

Opogona lachanitis, Meyr., B. J., XVII, 416-417 (1906)(1).
Opogona chalanitis, Lefroy, Ind. Ins. Life, p. 540 (1909)(2).

Described from Puttalam and Peradeniya, in Ceylon(1).

Larva in fungus-beds of termites(1 2).

Also occurs in India at Hoshangabad, where I found the moths freshly attracted to fungus-combs newly dug out of termitaria. We have it also from Chitorgarh (Rajputana), Nagpur, Bangalore and Coimbatore.

OPOGONA FUMICEPS, F. & R.

Opogona fumiceps, Felder, Lep. Novara, t. 139, f. 8 (1875)(1); Moore, Lep. Ceylon, III, 526 (1887)(2); van Deventer, Tijds. voor Ent., XLVI, 83, t. 10, ff. 1a, 1b (1904)(3); Meyr., B. J., XVII, 986 (1907)(4).

Recorded from Ceylon(1, 2, 4) and Java(3, 4).

Larva on *Cocos nucifera*(3). The larva and pupa are described and figured by van Deventer(3).

[The species described by Swezey (*Hawaii. Sugar Planters' Assocn., Entl. Bull.* 6, p. 19; 1909) as *O. fumiceps*, the larva feeding in sugarcane in New Guinea, is probably *O. autophyta*, Meyr., which is not Indian.]

ERECHTHIAS ZEBRINA, BUTL.

Argyresthia zebrina, Butl., A. M. N. H. (5) VII, 403 (1881)(1).
Ereunetis lanceolana, Wlsm., P. Z. S., 1897, 158(2).
Ereunetis xenica, Meyr., Tr. Linn. Soc. (2) XIV, 301 (1911)(3), Rec. Ind. Mus., V, 230(4).
Decadarchis xenica, Meyr., Exot. Micr., I, 367 (1915)(5).
Erechtias zebrina, Meyr., T. E. S., 1915, 253(6).
Ereunetis zebrina, Wlsm., Fauna Hawaii, I, 715-716, t. 25, f. 16 (1907)(7).

This species has been recorded from the West Indies(2, 6), Brazil(2), British Guiana(6), Hawaii(1, 6, 7), Borneo(3, 6) and the Seychelles(3, 6). Within our limits it appears to be plentiful in Ceylon, where it has been recorded from Puttalam, Kandy and Maskeliya(3), and is known in India from Calcutta(5), the Khasi Hills(3) and North Coorg(3). We have it from Shillong.

The larva "is doubtless a refuse-feeder and artificially spread"(6).

PYLŒTIS MIMOSÆ, STT. (PLATE LI, FIG. 2.)

Laverna ? mimosæ, Stainton, T. E. S. (n. s.), V, 126 (1859)(1); Lefroy, Ind. Ins. Life, p. 536 (1909)(2).
Ereunetis ? seminivora, Wlsm., Ind. Mus. Notes, IV, 107, t. 7, f. 2 (1898)(3); Lefroy, Ind. Ins. Life, p. 540 (1909)(4).
Pylœtis ophionota, Meyr., B. J., XVII, 752 (1907)(5).
Pylœtis mimosæ, Meyr., Rec. Ind. Mus., V, 231 (1910)(6).

Originally described from Calcutta(1); also recorded from Hooghly(2) and from Puttalam and Matale in Ceylon(5). I have also seen it from

Coimbatore and have taken it in March at Rajshahi, Bengal, so that it is doubtless widely distributed in the Plains of India and Ceylon.

Larva in seeds of *Acacia arabica*(1), in pods of *Cassia fistula*(3), in pods of *Cassia corymbosa* at Coimbatore.

DECADARCHIS MINUSCULA, WLSM.

Ereunetis minuscula, Wlsm., P. Z. S., 1897, 155-156(1), Fauna Hawaii Microlep., p. 716, t. 15, f. 17 (1907)(2).

Decadarchis minuscula, Meyr., Exot. Micr., I, 367 (1915)(3), Ann. Transvaal Mus., VI, 43 (1918)(4).

A very widely-distributed species recorded from the West Indies(1), South Africa(4), Hawaii(2) and Ceylon(3).

The larva feeds in dry vegetable refuse(4).

DECADARCHIS DISSIMULANS, MEYR.

Decadarchis dissimulans, Meyr., Exot. Micr., I. 368 (1915)(1).

Ereunetis melanastra, Meyr., B. J., XVI, 617 (1905) [*nec* Meyr., T. E. S., 1886, 291 = *simulans*, Butl.](2).

Described from Ceylon (Udagama, Peradeniya, Kegalle, and Kalutara)(1). We have it from Udagama.

Larva feeding on decaying bark of dead *Hevea brasiliensis* (Para rubber)(2), in dead bark and wood(1).

TISCHERIA PTARMICA, MEYR.

Tischeria ptarmica, Meyr., Rec. Ind. Mus., II, 399 (1908)(1); Lefroy, Ind. Ins. Life, p. 540 (1909)(2); Imms and Chatterjee, Ind. Forest Mem. (Zool.), III, 32 (1915)(3).

Described from Puri, in Orissa, where the larvæ were found "mining small elongate blotches in leaves of *Zizyphus jujuba* in January. The species occurred in great profusion, leaves an inch in diameter containing twenty or more larvæ and the moths are described as 'swarming like a cloud of midges round the tree.' The mine, larval habits, and pupa are similar to those of European species "(1).

Stainton (*Nat. Hist. Tin.*, III, 228) says of the larval habits of the European species :—"These mine the interior of leaves, and as far as is yet known, always the upper side, making large irregularly formed blotches of whitish or brownish colour; the interior of the mine is always beautifully carpeted with white silk, but the peculiarity of these mines is, that they are kept perfectly clean, not a single grain of excrement being ever to be found within " ....

"The larva never quits the mine, and changes therein to a pupa, not spinning any cocoon."

"Stebbing [*A Note on the Lac Insect* (*Ind. For. Mem.*) (*Zool.*), I, 21 (1910)] mentions that Dr. N. Annandale has bred out specimens of this small moth from lac obtained from Orissa "(³). It is more probable that the moths emerged from leaves on *ber* branches on which the lac was collected.

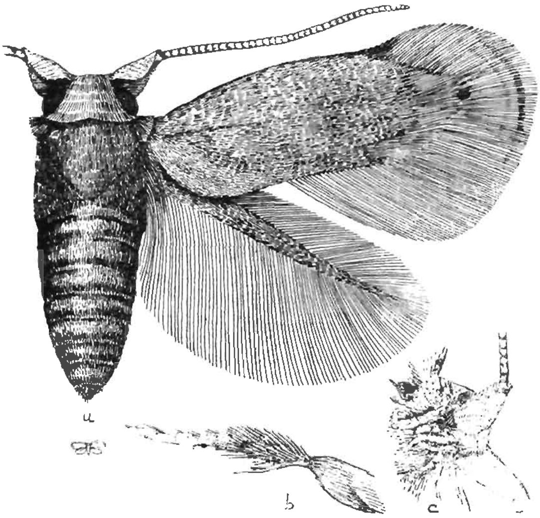
OPOSTEGA MYXODES, MEYR. (PLATE LII.)

Opostega myxodes, Meyr., Exot. Micr., I, 619 (1916)(¹).

Bred at Pusa in September and October 1915 from larvæ mining in leaves of *Cordia myxa* (Boraginaceæ)(¹).

Larvæ were found at Pusa on 24th September 1915 mining leaves of *Cordia myxa*. The larva pupates outside of the mine on any convenient surface in a dull-white cocoon of uniform texture, pupation occurring in an inner cocoon spun inside the outer one. The moths emerged on 1st and 2nd October.

PLATE LII.



Opostega myxodes:—*a*, Moth, natural size and magnified (x 27); *b*, hind leg; *c*, head of moth, seen from below, more highly magnified.

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

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MICROLEPIDOPTERA

VIII. TINEIDÆ AND NEPTICULIDÆ

BY

T. BAINBRIGGE FLETCHER, R.N., F.L.S., F.E.S., F.Z.

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AGRICULTURAL RESEARCH INSTITUTE, PUSA

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[Received for publication on 27th June 1919.]

TINEIDÆ.

MELASINA ENERGA, MEYR.

Melasina energa, Meyr., B. J., XVI, 616-617 (1905)([1]) ; Fryer, T. E. S., 1913, 420-422, t. 21, ff. 1-4([2]).

Described from Ceylon—Peradeniya([1,2]), Tangalla([1]) and Yatiyantota([1]). We have it from Peradeniya.

The larva has been described by Fryer as follows:—"The head is ovate in shape and is so attached to the first thoracic segment that the anterior surface is directed upwards, bringing the mouth forward ; in colour it is dark brown with the surface finely shagreened. The first thoracic segment is elongated and in front is slightly broader than the head but behind is markedly constricted ; its surface is chitinous, brown in colour and finely shagreened, this latter feature being less evident than in the case of the head. The remainder of the body is cylindrical, tapering slightly posteriorly ; in colour it is greenish-grey, lighter ventrally ; hairs are present but they are sparsely scattered and are very minute. The legs are brown in colour, rather long, and directed forward. The prolegs are very short and are armed with a series of broad hooks, the suckers being hardly functional. The spiracles are brown, those on the penultimate segment being large and conspicuous. Length 23 mm."([2]). The larvæ live in earthy tubes, projecting above the surface of the ground like worm-tubes. These tubes, when the larva is full-grown, measure 100 to 150 mm. in length, two-thirds of the tube descending

vertically into the ground, whilst the remaining one-third lies horizontally on the surface or winds its way into a mass of dead leaves. The tube is cylindrical in shape and measures from 6 to 8 mm. in diameter throughout its median portion ; towards the free-end it is funnel-shaped, widening out until at its termination it may measure 12 mm. in diameter. The subterranean end of the tube, when the larva is young, appears to open freely into the earth ; in the case of full-grown larvæ it widens considerably, thus forming a pupal cell. In composition the tube is built of a strong, closely woven silk, to the outside of which grains of earth, pieces of dead leaf and broken twigs are attached, the earth covering the subterranean portion, while the dead leaves and twigs encrust that above ground. The pupal cell is formed by the terminal 20 mm. at the bottom of the tube and differs from the remainder in its greater width and in the increased thickness of its silken walls. Inside the pupal cell lies a thin cocoon which is cylindrical in shape and flat at each end ; it is peculiar in that it is composed of fine silk matted together by some dark-coloured secretion. This cocoon fits fairly closely into the pupal cell, but for the greater portion of its length is only loosely attached to it by a few strands of silk ; at the extreme lower end, however, it is firmly woven to the lower lips of the cell so that the flat end of the cocoon entirely blocks the subterranean entrance. This arrangement seems peculiar for, while the walls of the pupal cell are very thick, the end is guarded solely by the thin flat silken disc which forms the bottom of the cocoon. The similar disc, which forms the upper end of the cocoon, is easily detached and on the emergence of the moth is pushed up like the lid of a box. In the few cases examined the empty pupa skin was found in the cocoon.

The food of the larva consists of dead leaves and often decaying vegetable matter, feeding being accomplished only at night. (*Fryer.*)

MELASINA GRANULARIS, MEYR.

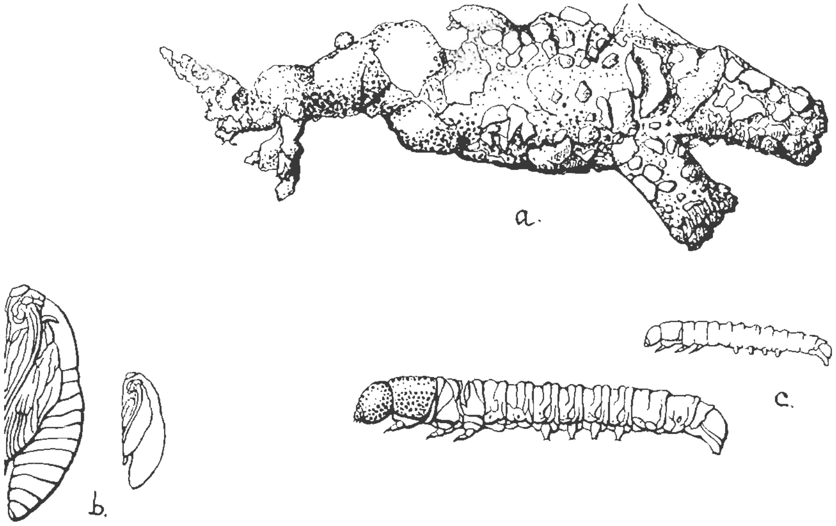
Melasina granularis, Meyr., Exot. Micr., I, 609 (1916)([1]).

Bred at Peradeniya in March. " Larva in a long nearly cylindrical case of silk covered with refuse (length 12 mm., breadth 2 mm.), mostly whitish sometimes banded with grey, feeding on lichens beneath ledges of rocks and on trunks of trees (*Green*) "([1]).

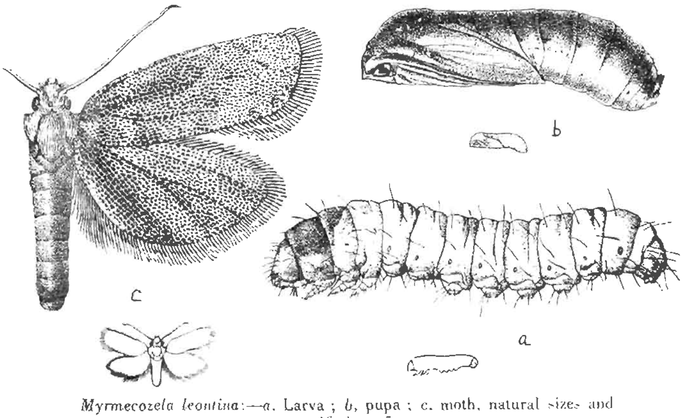
MELASINA CAMPESTRIS, MEYR. ? (PLATE LIII.)

Melasina campestris, Meyr., Exot. Micr., I, 611 (1916)([1]).

This species is abundant at Pusa about June and has been bred from larvæ found living in silken tubes lying on the surface of the soil but it is not



Melasina campestris (?) :—*a*. Larval tube (x 2) ; *b*. pupa, natural size and magnified (x 2) ; *c*. larva, natural size and magnified (x 2).



Myrmecozela leontina:—*a*. Larva ; *b*, pupa ; c. moth, natural sizes and magnified (x 5).

certain whether the following description applies to *M. campestris* or to *M. devincta*, Meyr., or *M. ramifera*, Meyr., as all these three species are common at Pusa and the larvæ have not been distinguished. The larvæ form silken tubes which go down practically vertically into the soil to a depth of several inches. In confinement the larvæ have been observed to go right down to the bottom of a glass jar through about six inches of earth. The tubes are generally formed in dry and rather dusty places. The larva feeds apparently on dead leaves and grasses available on the ground, but in confinement occasionally eats fresh leaves and has been observed to gnaw a cork. The larva is about 25 mm. long, cylindrical, pale yellow, soft, with five pairs of prolegs; head and upper surface of prothorax thickly chitinized and shiny, reddish-brown to black; the surface of the head and prothoracic shield varies in different individuals from smooth to slightly corrugated transversely, but even when smooth there is a faint trace of corrugations. (It is not known whether this variation is individual or characteristic of specific differences, but no other differences were observable.) Pupation takes place in a stiff cocoon formed near the bottom of the tube below the surface of the soil. In the case of three pupæ found on 27th May 1915 the tube in each case had been carried about 40 mm. below the surface of the soil and at that depth had been closed entirely and a cocoon formed at this lower end; this portion of the end of the tube is rather stiff, no doubt rendered so by the addition of a good deal of silk; the remaining portion of the tube is soft like the tubes in which the larvæ are found and the upper end is prolonged slightly above ground-level, its mouth being open; the head of the pupa is turned towards the mouth of the tube and the upper end of the cocoon is closed with a rather thick silken membrane which, however, is easily burst. On emergence of the moth, the pupa wriggles to the surface and the pupa-case is left protruded from the end of the tube or may lie entirely clear of the tube. Tachinid, Ichneumonid and Chalcidid parasites have been bred from these larvæ and pupæ. Eggs, obtained from bred moths, were laid in a cluster, gummed to one another on the wall of a glass cylinder. The egg is slightly elongate-oval or cylindrical with rounded ends, about 0·7 mm. long and 0·5 mm. broad, smooth, hardly shiny, creamy white. (Pusa Insectary Cage-slips 1229, 1387.)

MYRMECOZELA LEONTINA, MEYR. (PLATE LIV.)

Myrmecozela leontina, Meyr., B. J., XXI, 126(¹).

Originally described from Kulu(¹) and Pusa(¹), this species is abundant in the adult state at Pusa in June and July and we have it also from Chapra (Bihar).

It has been bred at Pusa from larvæ collected on 5th to 25th June 1916 in silken tubes amongst *dabhi* grass. On 30th June 1916 no more larvæ could be found although pupæ and empty pupa-cases were then found in the tubes. The larvæ are found in silken tubes which extend almost vertically downwards for several inches into the soil. At the mouth of the tube bits of dry grass and other rubbish are knitted together and these lie on the ground and completely hide the presence of the tube. The larva is very like that of *Melasina* but is apparently distinguishable by its smooth head—transversely corrugated in *Melasina*. The full-grown larva is about 18 to 20 mm. long, cylindrical, pale yellow; head smooth, red-brown; prothoracic shield large, lighter brown than head and divided by a narrow yellow medial line; hairs on segments long, not arising from tubercles; five pairs of equally developed, short prolegs.

Pupation takes place within the larval tube, no special cocoon being formed. The pupa is about 12 to 14 mm. long and about 2·5 to 3 broad, cylindrical, slightly bent ventrally; on the dorsal region of the anal segment there is a pair of pointed processes arising from a common transversely-flattened base and with their tips directed anteriorly. By wriggling movements and with the help of these processes, the pupa can move freely up and down the silken tube. Before emergence of the moth the pupa wriggles up to the mouth of the tube and partly issues out of it before the moth escapes. (Pusa Insectary Cage-slip 1404.)

MYRMECOZELA TINEOIDES, WLSM.

Setomorpha tineoides, Wlsm., P. Z. S., 1886, 465, t. 41, f. 8(1); van Deventer, Tijds. voor Entom., XLVI, 81-82, t. 9, f. 3 (1904)(2); Pagenstecher, Lep. Bismarck Archip., II, 232 (1900)(3); Lefroy, Ind. Ins. Life, p. 540, t. 28, f. 10 (1909)(4).

Amydria tineoides, Wlsm., P. Z. S., 1907, 1018-1019 (1908)(5).

Originally described from Mhow(1). "Not uncommon in India"(4) and probably widely distributed.

Larva figured by Lefroy(4) and van Deventer(2); the latter is probably more accurate and shows the larva as 5 to 6 mm. long, whitish, head shining brown with lighter intersutural lines, plate of two large, narrowly divided medially, brownish, plates of 3 and 4 smaller, broadly divided, brownish; it lives in a case about 6 to 8 mm. long by some 2 mm. broad, broadest and slightly flattened in the middle, slightly expanded at either end.

Food:—Dried tobacco leaves (4).

[*Note.* It is possible that Lefroy's figure, ascribed to this species, really represents the larva of *Setomorpha insectella*.]

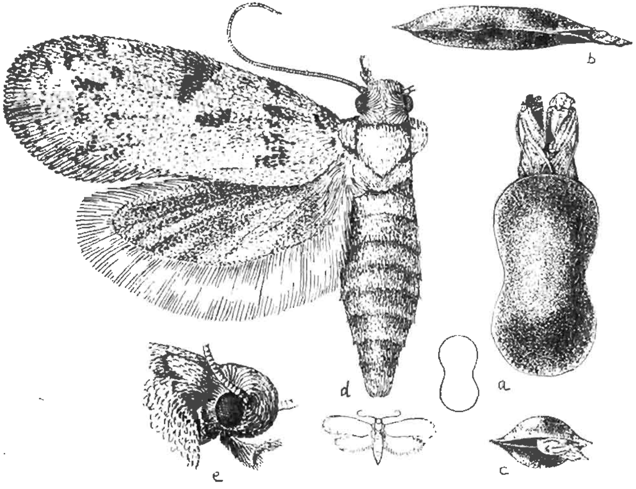


Fig. 1. *Hypophrictis inceptrix*: *a*. Larval case, with extruded pupa (x 2½). The outline figure shows the natural size; *b*, larval case, with extruded pupa, seen from side (x 2½); *c*, larval case, with extruded pupa, seen from end (x 2½); *d*, moth, natural size (in outline) and magnified (x 7); *e*, head of moth, side-view, more highly magnified.

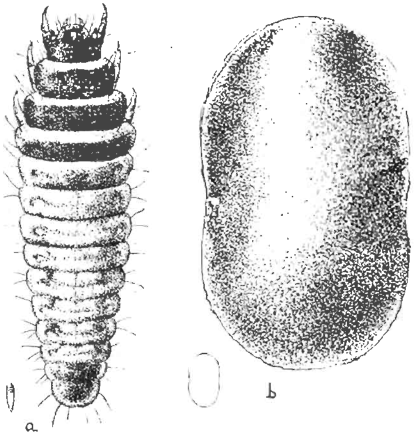


Fig. 2. *Hypophrictis sp.*:—*a*. Larva extracted from case, natural size and magnified (x 13); *b*, larval case, natural size (in outline), and magnified (x 7).

MYRMECOZELA ? CORTICINA, MEYR.

Amydria ? corticina, Meyr., M.S.

This species was reared at Pusa on 19th March 1914 from a larva found boring into bark of *banyan* (*Ficus bengalensis*) on 26th January. The larva was described as slender with a black head and prothoracic shield and five pairs of prolegs, but, as a specimen of *Latypica albofasciella* was also reared, it is uncertain to which larva this description applies. (Pusa Insectary Cage-slip 1035.)

MACHÆROPTERIS HALISTREPTA, MEYR.

Machæropteris halistrepta, Meyr., B. J., XXI, 128-129 (1911)(1).

Described from Puttalam in Ceylon, Gooty in Madras, and the Konkan(1). We have it from Coimbatore, Hospet (Bellary) and Pusa.

Larva in elongate, nearly flat, parallel-sided case (12×4 mm.), both ends rounded, composed of silk and grains of refuse, but entirely coated with silk outside(1).

It has been reared at Pusa from larvæ found in tubes.

HYPOPHRICTIS INCEPTRIX, MEYR. (PLATE LV, FIG. 1.)

Hypophrictis inceptrix, Meyr., Exot. Micr., I, 605 (June 1916)(1), *id.*, *l.c.*, II, 85 (1917)(2).

Described from Ceylon (Haputale) and Karwar in North Kanara(1). Moths were also taken at Pusa in September 1908 and October 1911.

"Larva found in nests of *Cremastogaster* (Formicidæ) at Ambalangoda, Ceylon, and imago bred in December at Pusa; in a singular nearly flat case composed (apparently) of two dark grey sections of stout silk joined together round the edges, shaped somewhat between an ellipse and an hour-glass, or like two coalescing circles, length 15 mm., greatest width 8 mm., contracted in middle to 6 mm.; pupa protruded from end in emergence "(2).

HYPOPHRICTIS (?) PLANA, MEYR. MS.

This species has been reared at Pusa from a larva found on a mango-trunk on 28th June 1906. The larva was described as about 12 mm. long, flat, tapering towards either extremity but more so posteriorly, segments well defined, pale yellowish-white; head flat, black, shiny, smaller than prothorax; prothorax and mesothorax wholly covered by a black shield; five pairs of minute prolegs. The larva lives in a flat 8-shaped case consisting of two thin 8-shaped parchment-like pieces attached to each other permanently by means of silk at the constrictions and coinciding along their margins. On the outside

these side-pieces are dry-earth colour and whitish inside. The larva extrudes itself from one of the ends up to about the metathorax, whilst it walks and feeds, the remainder of the body being protected by the case. When disturbed it withdraws its head inside the case. Pupation takes place within the case, the pupa wriggling out to some extent to one end of the case on emergence of the moth, which appears in November. There seems to be only one brood annually. (Pusa Insectary Cage-slip 380.)

HYPOPHRICTIS SP. (PLATE LV, FIG. 2.)

A Tineid larva, apparently belonging to a species of *Hypophrictis*, was found at Pusa in January 1916 underground in the nest of an ant, *Polyrhachis* sp. It was enclosed in a flat silken case as shown in figure *b*. Unfortunately the larva died and no more have been found, so that the moth has not yet been reared. It may possibly belong to *H. sollicita*, Meyr. (*Exot. Micr.*, II, 85) which was also described from Pusa.

SCARDIA SISTRATA, MEYR.

Scardia sistrata, Meyr., Exot. Micr., I, 618 (1916)(1).

Described from Puttalam, Wellawaya and Peradeniya in Ceylon and from Pusa(1). We have it from Pusa, Chakradharpur and Coimbatore.

Larva feeding in decayed fungus (*Polyporus*)(1). At Coimbatore this species was reared from larvæ in fungus and at Pusa from larvæ in fungus (*Fomes* sp.).

Larvæ were found at Pusa on 22nd August 1908, boring into the thick tissue of *Fomes* sp. and producing tunnels filled with pellets of frass. Externally the presence of the larvæ in the fungus is indicated by dry pellets of frass webbed together into small masses. The larva was described as about 20 mm. long and 2·5 mm. broad, cylindrical, pale yellow, skin soft and transparent; head and prothoracic shield brown, shiny; five pairs of fully developed prolegs. Pupation takes place inside the tunnels in the fungus, the pupæ being found near the mouths of the tunnels which open externally, the opening being closed with silk and excrement. The pupa is about 12 to 13 mm. long, cylindrical, brown; third and following abdominal segments with two transverse ridges across dorsum, the ridges surmounted by fine raised points; anal segment with a pair of curved hooks on ventral side. On emergence of the moth, the pupa wriggles out of the tunnel to some extent and, when the moths have emerged, many empty pupa cases are found projecting out of the body of the fungus. (Pusa Insectary Cage-slip 741.)

EUCROTALA NUCLEATA, MEYR.

Eucrotala nucleata, Meyr., Exot. Micr., II, 96 (1917)(1).

Bred in June from (bark or wood, probably, of) *Shorea robusta* from Gumna Range, Goalpara District, Assam (*Beeson*)(1).

HAPSIFERA RUGOSELLA, STT.

Cerostoma rugosella, Stainton, T. E. S. (n. s.), V, 113-114 (1859)(1); Wlsm., P. Z. S., 1885, 883(2).

Dasyses rugosellus, Durrant, Ind. Mus. Notes, V, 104, t. 15, f. 3 (1903)(3); Lefroy, Ind. Ins. Life, p. 540 (1909)(4).

Dasyses rugosella, Meyr., Ann. Transv. Mus., III, 335 (1913)(5).

Psoricoptera ? hirsutella, Wlsm., T. E. S., 1881, 261, t. 12, f. 29(6).

Scalidomia hirsutella, Wlsm., T. E. S., 1897, 65(7).

Dasyses rugosellus, Proc. Second Entl. Meeting, p. 257 (1917)(8).

Originally described from Calcutta(1), but widely distributed in and outside of India, being known from Natal(6), Gambia(7) and French Congo(7); also recorded from Barrackpur(3)*, Poona(2) and Peradeniya(3). We have it from Pusa, Dharwar and Coimbatore.

Larva in galleries in fibrous stem of dead *Cycas circinalis*(3), in dead wood(5), in mango and *gular* bark and in frass of a Cerambycid borer in mango(4). Larva found in dead papaya tree at Pusa. Also bred from papaya stem at Coimbatore.

The larva is about 25 mm. long, cylindrical, slightly tapering posteriorly, very soft, dirty pale yellow, skin almost transparent showing dark contents of alimentary canal; head and prothoracic shield shiny dark-brown; scattered grey hairs on segments; five pairs of prolegs. Pupation in a white cocoon found in the wood-dust or in any small corner of the bark. The pupa wriggles out of the cocoon to some extent on emergence of the moth. The larva lives in (probably dead) bark of mango, *Ficus glomerata* and papaya.

HAPSIFERA SECLUSELLA, WLK.

Cimitra seclusella, Wlk., Cat., XXIX, 780(1).

Hapsifera seclusella, Moore, Lep. Ceylon, III, 499, t. 208, ff. 12, 13 (1887)(2); Warren, P. Z. S., 1888, 338(3).

Amydria seclusella, Meyr., Entom. Mitteil. Suppl., III, p. 61 (1914)(4).

* *Note.* Durrant's record from "Bekpur" is obviously based on a misreading of a contraction for Barrackpur. The same error occurs in Swinhoe's *Catal. Het. Oxf. Mus.* in connection with other species.

Originally described from Ceylon[1], this species is widely distributed in India, where it has been recorded from Campbellpur[3], and has also been found in Formosa[4]. We have it from Peradeniya, Chapra and Pusa.

At Pusa it has been reared from farmyard manure (cowdung) collected on 25th June 1916. The larva was boring the lumps of cowdung and living inside a silken tube around which pieces of cowdung and pellets of frass were fastened. Pupation took place in elongate-oval silken cocoons with stout walls and the pupa wriggled out to some extent through one end of the cocoon just before emergence of the moths, which took place from 13th to 23rd July. (Pusa Insectary Cage-slip 1416.)

SETOMORPHA INSECTELLA, FB.

Tinea insectella, Fabr., Ent. Syst., III, ii, 303 (1794)[1].

Setomorpha rutella, Zeller, Micr. Caffr., pp. 94-95 (1852)[2]; Wlsm., T. E. S., 1891, 81-82, t. 7. f. 73[3]; Cotes, Ind. Mus. Notes, II, 9-10 (1891)[4], *l. c.*, p. 164 (1893)[5]; de Nicev., *l. c.*, V, 201-202 (1903)[6]; Wlsm., Fauna Hawaii, I, 754 (1907)[7]; Lefroy, Ind. Ins. Life, p. 540 (1909)[8]; Meyr., Tr. Linn. Soc. (2), XIV, 302 (1911)[9].

Setomorpha insectella, Wlsm., P. Z. S., 1907, 1016-1019 (1908)[10].

A cosmopolitan species described, under at least eight other names, from North and South America, Hawaii, West-Indies, West and South Africa, Seychelles, India, Ceylon, Celebes, Makassar, and Queensland. [For more complete synonymy and distribution, see[10].] We have it from Pusa, Rangpur, Coimbatore, Darjiling, Mercara, Pollibetta and Nagpur.

Larva on dead animal and vegetable matter—on muscular fibre attached to skull of a hippopotamus[10], destructive to bales of country-blankets in Calcutta[4, 5], destructive to insect collections[1, 10], on various dried vegetable substances[9].

This species has been bred at Pusa on several occasions from larvæ found feeding on dry tobacco leaves, also from larvæ on stored coriander seeds, on *Setaria italica* grain in store, on wheat flour, and on *Dolichos biflorus* (seeds ?), and at Nagpur it has been reared on bean (in store ?).

The egg is about 0·25 mm. long by 0·17 mm. broad, pearly white, changing to very light-brown before hatching. The eggs are laid singly. Before depositing an egg the female extrudes her ovipositor for about 2 mm. and moves it from side to side, then raises it upwards between the wings and then with a jerk deposits an egg at the utmost reach of the ovipositor, and then moves to another place to lay another egg. The eggs hatch in about eight days, the young larva being about 1·25 mm. long, with a light-brown head.

The full-grown larva is about 17 mm. long, cylindrical, dirty-white, skin transparent, head red-brown, prothoracic shield greyish-brown; spiracles black; segments with minute scattered brown hairs; five pairs of prolegs.

Pupation takes place amongst the larval food (*e.g.*, dried tobacco leaves) in a tough white cylindrical cocoon. Pupa about 5 mm. long, cylindrical, tapering posteriorly, anteriorly light brown, posteriorly whitish. Pupal period about nine days in August. (P. G. Patel's Cage-slip 23.)

LATYPICA ALBOFASCIELLA, STT.

Cerostoma albofasciella, Stainton, T. E. S. (n. s.), V, 114 (1859)([1]).

Latypica albofasciella, Meyr., Exot. Micr., I, 606 (1916)([2]).

Originally described from Calcutta([1]) and since recorded from Pusa([2]) and Dibidi (Coorg)([2]), we have this species from Chapra and the Shevaroy Hills, and from Pusa in April, June, September and November (mostly in June). A specimen was reared on 14th April 1914 from a larva found boring into bark of *banyan* (*Ficus bengalensis*) on 26th January 1914 and described as slender with a black head and prothoracic shield and five pairs of prolegs; but, as a specimen of *Myrmecozela corticina* was also reared under these *data*, it is uncertain to which larva this description really applies. (Pusa Insectary Cage-slip 1035.)

ATABYRIA BUCEPHALA, SNELL.

Atabyria bucephala, Snellen, Tijds. voor Entom., XXVII, 166, t. 9, ff. 1, 1a, 1b (1884)([1]); Meyr., Ann. Transv. Mus., III, 82([2]).

Originally described from Eastern Siberia([1]), this species is widely distributed and has been recorded from Borneo([2]) and Natal([2]). In India it is known from Chapra, Pusa, the Shevaroy and Khasi Hills.

The larva has not been described but the moth was bred from cocoons about a fungus growth on a tree at Yercaud, Shevaroys, in May 1913.

ELEGISTIS CUNICULARIS, MEYR.

Elegistis cunicularis, Meyr., B. J., XXI, 125-126.

Described from Maskeliya and Peradeniya, in Ceylon, the larva tunnelling dead wood, making long external tubes of silk and refuse([1]).

LEPIDOSCIA GLOBIGERA, MEYR.

Lepidoscia globigera, Meyr., B. J., XXI, 124-125([1]).

Described from Haputale in Ceylon, the larva in a sub-globose, egg-shaped case of silk covered with grains of refuse, feeding on lichens; length of case 8-10 mm., width 5-7 mm.([1]).

TINEA OPSIGONA, MEYR.

Tinea opsigona, Meyr., B. J., XXI, 123([1]).

Occurs throughout India and Ceylon. We have it from Coimbatore, Pusa, Chapra, Rajshahi and Gurdaspur.

The larva does not seem to be known definitely, but in *Ent. Mo. Mag.*, 1898, p. 245, Lord Walsingham says that he knows "at least five Indian species [of *Tinea*] closely allied to *vastella*, one of which (*orientalis*, Stt.) is also a horn-feeding species." I do not know of any Indian *Tinea* described by Stainton as *orientalis*, which is probably a manuscript (unpublished) name equivalent with *opsigona*, Meyr., which has frequently been mis-identified with the African horn-feeding *vastella*, Z. Frequent inquiries from sportsmen in India have so far failed to reveal any knowledge of the presence of a horn-feeding *Tinea* in India.*

TINEA FRUGIVORA, MEYR. (PLATE LVI, FIG. 1.)

Tinea frugivora, Meyr., Exot. Micr., II, 77 (1917)([1]).

Described from one specimen taken at Coimbatore in July and from a series bred in November and December from fruits of *Trichosanthes* (containing larvæ of a *Chætodacus* (Trypaneidæ)) collected at Lashio, 3,000 feet, Northern Shan States, in August, but probably the dried remains of the fruit were attacked later on the journey or at Pusa. The moths emerged between 14th October and 4th December 1914.

TINEA PELLIONELLA, LINN. (PLATE LVI, FIG. 2.)

Tinea pellionella, Linn., Syst. Nat. (ed. X), I, 536 (1758)([1]); Meyrick, Handbook, p. 791 (1895)([2]); Wlsm., P. Z. S., 1907, 1025 (1908)([3]).

A cosmopolitan household pest, recorded from Europe, North America, North and South Africa, West-Central Asia, Ceylon, Japan, Australia and New Zealand. We have it from Rawalpindi, Madras, Pusa and Coimbatore and it is doubtless common throughout our limits.

Larva whitish; head brown; plate of 2 dark brown; in a case on cloth, feathers, hair, etc.([2]).

A common household "clothes-moth," the larva feeding on furs, feathers, bird's nests, stuffed birds, woollens, clothes, carpets, etc. At Coimbatore

* *Note.* Since the above was sent to press, I have come across two cases at Sadiya, in North-East Assam, in which dead buffalo horns had been attacked by a horn-feeding larva, the empty pupa-cases remaining protruding from galleries eaten through the surface of the horn. As no moths were obtained, the species concerned cannot be identified. I should be glad to hear of any similar cases in India or to receive specimens of horns attacked by larvæ. [T. B. F.]

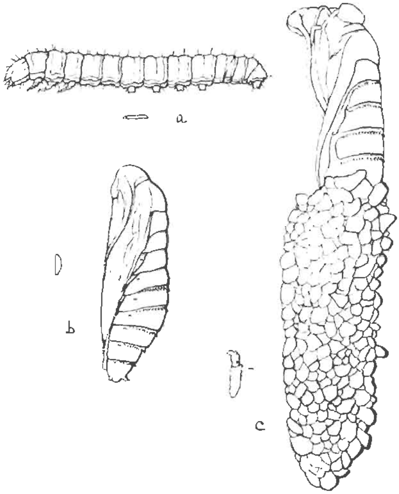


Fig. 1. *Tinea frugivora*:—*a*, Larva, natural size and magnified (x 11) ; *b*, pupa, natural size and magnified (x 11) ; *c*, pupa, extracted from cocoon; natural sizes and magnified.

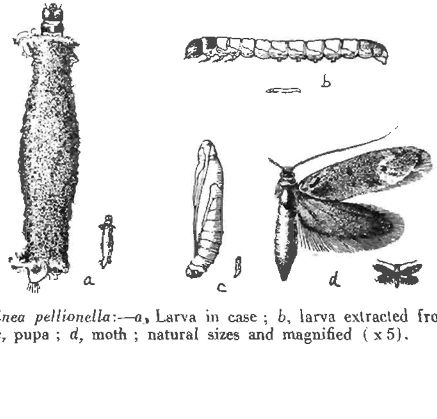


Fig. 2. *Tinea pellionella*:—*a*, Larva in case ; *b*, larva extracted from case ; *c*, pupa ; *d*, moth ; natural sizes and magnified (x 5).

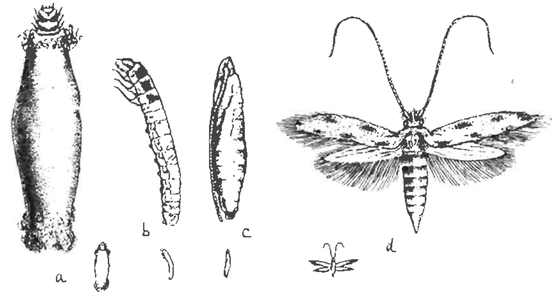


Fig. 1. *Macrarola inquisitrix*:—*a*. Larva in case ; *b*. larva extracted from case ; *c*. pupa ; *d*. moth ; natural sizes and magnified (×5).

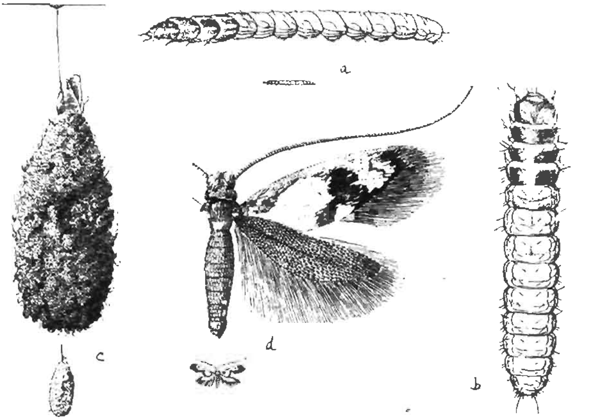


Fig. 2. *Crypsithyris longicornis*:—*a*, Larva, natural size, side view, and magnified (×5) ; *b*. larva, dorsal view, magnified (×8) ; *c*. cocoon suspended from thread, with extended pupa, natural size, and magnified (×4) ; *d*, moth, natural size and magnified.

it has been bred from larvæ feeding on cloth lining of pith helmet, on woollen cloth, on Balaclava cap and on deer-skin, and at Pusa on clothes, on fur, on wool and on woollen cloth. It has also been sent in to us in February 1918 as infesting stored brushes in the Army Clothing Depôt, Madras, and in March 1918 as attacking Kashmir *numdahs* in the Army Divisional Supply Depôt at Rawalpindi.

The larva lives in a flattened silken case or bag covered with portions of the larval food. The larva is about 6 mm. long and 0·75 broad, cylindrical, dirty-white; head and large prothoracic shield dark-brown, shiny; five pairs of prolegs. Pupation takes place in the larval case, the pupa wriggling out through one end before emergence of the moth and remaining protruded from the empty case.

This is a destructive species to clothes, etc., of animal origin, breeding throughout the year. It is best kept at bay by frequent and regular sunning of clothes or by storing them with ample supplies of powdered naphthalene.

TINEA PACHYSPILA, MEYR.

Tinea pachyspila, Meyr., B. J., XVI, 619 (1905)(1), Rec. Ind. Mus., V, 231 (1910)(2), Tr. Linn. Soc. (2), XIV, 305 (1911)(3); Lefroy, Ind. Ins. Life, p. 540 (1909)(4); Fletcher, S. Ind. Ins., pp. 466-467, f. 342 (1914)(5).

Common throughout Ceylon(1, 3); also recorded from Trivandrum(2) and the Seychelles(3).

Larva living in a case on flannel, fur, etc.(3).

TINEA FUSCIPUNCTELLA, HAW.

Tinea fuscipunctella, Haworth, Lep. Brit., p. 562(1); Meyr., Handbk., p. 791(2), Rec. Ind. Mus., V, 231 (1910)(3); Wlsm., E. M. M., 1907, 267(4).

A cosmopolitan household pest, known to occur practically all over the world. In India recorded from Kurseong(3) and the Simla Hills(3). We have it from Calcutta and Simla.

Larva in spun tube; a refuse-feeder found on dried fruit, dried peas, etc. on all kinds of waste substances, on offal, in bird's nests, on meal-worm workings, etc.(4).

MACRÆOLA INQUISITRIX, MEYR. (PLATE LVII, FIG. 1.)

Macræola inquisitrix, Meyr., Exot. Micr., I, 602 (June 1916)(1).

Described from Pusa, where it was bred from a larva feeding on a dead wasp(1).

This species is abundant at Pusa in the larval stage, the larvæ being seen creeping over walls inside houses, dragging about their small cases

During the cold weather the larvæ are not much in evidence and seem to hibernate, but from about the end of February onwards they are sufficiently common. The larva seems to feed on dead organic matter of animal origin, such as dead insects or insect excreta. The larva is about 5 mm. long and about 0·8 mm. across prothorax, the mesothorax and metathorax rather narrower, the abdomen broadening to about 1 mm. towards anal extremity, convex dorsally, flattened ventrally, whitish-yellow; head dark chestnut-brown or black, shiny, with comparatively large antennæ; prothorax with a black shiny dorsal plate narrowly divided medially and also a similar ventral plate; mesothorax with a black shiny medially-divided dorsal plate and ventrally with a smaller ventral plate; metathorax with a less strongly chitinized medially divided dorsal plate; legs very developed, the second pair longer than the first, and the third pair longer than the second and about twice as long as the first; scattered whitish hairs on body; five pairs of minute prolegs. The larva lives inside a flattened grey silken case which may measure 10 mm. long by 2·5 mm. broad across the middle, tapering towards both extremities which are open and similar. The larva is not fixed inside the case but can project its head from either end at will. The exact length of life-cycle has not been noted.

TINEOLA BISSELLIELLA, HUMM.

Tineola bisselliella, Hummel, Essais Ent., III, 6-12, 13-14 (1823) (1); Wlsm., P. Z. S., 1907, 1026 [references](2).

This is an almost world-wide species, doubtless spread artificially, and known to occur in Europe, North Africa, North America, Australia and New Zealand. It has not been recorded from India before, but we have it from Peshawar and it is probably widely distributed within our limits.

The larva is described by Meyrick (*Handbook*, p. 782) as "whitish; head brown; on hair, wool, etc." Frohawk (*Entom.*, XX, 233) records a larva which lived for three years, feeding on bird's feathers.

TRICHOPHAGA ABRUPTELLA, WOLL.

Tinea abruptella, Wollaston, A. M. N. H. (3) I, 120 (1858)(1).

Tinea bipartella, Rag., Bull. S. E. Fr., 1892, 93(2).

Trichophaga abruptella, Wlsm., P. Z. S., 1907, 1020-1021 (1908)(3); Fletcher, Entl. Note 92 (1916)(4).

Trichophaga tapetzella, [nec Linn.], Fletcher, S. Ind. Ins., p. 467, f. 343 (1914)(5).

Recorded from Madeira, the Canary Islands, Tunis, Egypt, Somaliland and Aden. Common throughout India. We have it from Pusa, Coimbatore and Bhutan.

This species has been reared at Pusa from larvæ found attacking the fur of a deer's hide. The larvæ live next to the skin, hidden amongst the hairs, which they eat. The attacked hairs do not fall off at once, as their cut bases are bound up in a greyish silken webbing which the larvæ exude and in which they live, their frass sticking to this webbing. At the slightest pull the hairs come off in large tufts along with the silken webbing, leaving the skin quite bare.

The full-grown larva is about 10 mm. long and about 1·25 mm. broad, cylindrical, yellowish dirty white, skin soft and transparent; head yellow brown; segments with thin white scattered hairs; five pairs of equally developed prolegs.

Pupation takes place inside the silken webbing in a white silken cocoon. The pupa is about 6 to 7 mm. long, yellow brown; anterior portion of dorsum of abdominal segments with a transverse row of small spines which increase in size on the successive segments towards anal extremity; anal segment dorsally with hook-like spines with their tips bent anteriorly. The pupa wriggles out of the cocoon for about half its length before emergence of the moth; in some cases the empty pupa case is entirely pulled out by the emerging moth.

In spite of their concealed mode of life, the larvæ are liable to be parasitized by a Tachinid fly. (Pusa Insectary Cage-slip 824.)

CRYPSITHYRIS HYPNOTA, MEYR.

Crypsithyris hypnota, Meyr, B. J., XVII, 753-754 (1907)(1).

Described from Peradeniya, where the larva occurs in a case on lichens under rock-ledges(1).

CRYPSITHYRIS LONGICORNIS, STT. (PLATE LVII, FIG. 2.)

Tinea longicornis, Stainton, T. E. S. (n. s.), V, 113 (1859)(1).
Crypsithyris longicornis, Lefroy, Ind. Ins. Life, p. 539 (1909)(2).

Originally described from Calcutta(1). Also occurs at Pusa.

The " larva lives in the little oval case found commonly on plastered walls in Indian houses; the case is of fragments and apparently spiders' webbing woven up with silk and the larva moves slowly along the wall. Its nourishment is apparently the size in the whitewash or some similar organic material.

The pupa is in the case which is then hung from the ceiling by a thread, the pupa emerging at the upper end for the moth to escape "(2).*

Larvæ have been found at Pusa from November to March, walking on whitewashed walls. They rest motionless during the daytime and appear to move and feed only at night. The larva lives in a clumsy case which appears to be very large in comparison with its own size. It probably feeds on lichens.

CRYPSITHYRIS MESODYAS, MEYR.

Crypsithyris mesodyas, Meyr., B. J., XVII, 753 (1907)(1).

Described from Peradeniya where it was bred from a larva feeding on lichens on rocks and trees(1).

MONOPIS DICYCLA, MEYR.

Monopis dicycla, Meyr., B. J., XVI, 618 (1905)(1), Rec. Ind. Mus., V, 231 (1910)(2).

Recorded from Maskeliya in Ceylon(1), and from Calcutta(2).

Larva destroying woollen cloth(2).

MONOPIS HEMICITRA, MEYR.

Monopis hemicitra, Meyr., B. J., XVII, 417 (1906)(1).

Originally described from Puttalam (Ceylon)(1), this species was bred at Coimbatore in June 1916 from larvæ in a Mantid egg-mass.

MONOPIS MONACHELLA, HB.

Tinea monachella, Hubner, Tin., f. 143(1).

Tinea longella, Wlk., Cat., XXVIII, 479 (1863)(2).

Blabophanes longella, Moore, Lep. Ceylon, III, 503, t. 209, f. 1 (1887)(3).

Blabophanes monachella, Meyr., T. E. S., 1894, 27(4), Handbk., p. 785 (1895)(5).

Monopis monachella, Wlsm., Fauna Hawaii, I, 727-728(6); Meyr., Entom. Mitteil. Suppl., III, p. 59 (1914)(7).

A very widely distributed species, originally described from Europe(1), also recorded from Labrador, West and South Africa(6), Hawaii(6) and Formosa(7). Within our limits it occurs throughout India, Burma and Ceylon. We have it from Madulsima, Maskeliya, Nilgiris (4,300 feet), Palnis, Belgaum, Chapra, Pusa and Masuri.

Larva among rubbish—in bird's nests—in skins(6).

* *Note.* I am uncertain whether this account really applies to this species. It almost certainly includes *Macræola inquisitrix* (*q. v.*) whose larva lives on dead organic matter and is seen commonly in a little case as described. The case is of course suspended by the larva *prior* to pupation. [T. B. F.]

INCURVARIADÆ.

The only species of this family recorded as Indian is *Eriocottis fuscanella*, Z., an inhabitant of South Europe and Asia Minor, recorded from Karachi by Cotes and Swinhoe (*Cat. Moths India*, p. 704) and whose larval habits do not seem to be known. In the European genus *Incurvaria* "the larvæ either begin life as leaf-miners, afterwards living in flat cases formed of two pieces of leaf, or they are shoot-borers." (Stainton, *Nat. Hist. Tin.*, XIII, 56.)

ADELIDÆ.

Some twenty-five species of the genus *Nemotois* have been recorded as occurring within our limits, mostly in the Hills, the moths being easily recognisable by their immensely long antennæ and usually brilliant metallic markings, but the early stages of no Indian species appear to be known. In Europe the larvæ "feed on seeds in their earliest youth, and afterwards construct flat, bivalve cases and feed on the lower leaves of their foodplant or on other leaves." (Stainton, *Nat. Hist. Tin.*, XIII, 194.)

NEPTICULIDÆ.

The known larvæ of *Nepticula* mine galleries or blotches in leaves, and are without developed legs or prolegs, but with paired rudimentary ventral processes on segments 3, 4 and 6-11, or occasionally quite apodous. Pupa in a firm cocoon, usually outside the mine. A full account of the group is given by Tutt (*Brit. Lep.*, I, 162-360).

NEPTICULA ARGYRODOXA, MEYR.

Nepticula argyrodoxa, Meyr., Exot. Micr., II, 181-182 (1918)(1).

"Bred at Pusa in November from larvæ mining leaves of *Desmodium* sp. (Leguminosæ)"(1).

Larvæ were found at Pusa on 13th November 1916 mining under the epidermal layer on the upper surface of the leaves of *Desmodium* sp. The mine is narrow and zigzag and may spread all over the surface of the leaf. Inside the mine there is a thin streak of excrement. When the larva is full-fed it leaves the mine and forms a roundish, flattened, scale-like, brown, silken cocoon either on the surface of the same leaf or on its stalk or stem or on another leaf. The pupa emerges partially through one end of the cocoon before the moth emerges, and the empty pupa-case is left protruding from the cocoon. Moths were reared between 21st November and 3rd December 1916. Several parasites were also bred out. (Pusa Insectary Cage-slip 1496.)

NEPTICULA ISOCHALCA, MEYR.

Nepticula isochalca, Meyr., Exot. Micr., II, 6 (Oct. 1916)([1]).

"Bred at Pusa in June from *Phyllanthus emblica* (Euphorbiaceæ) ; cocoon whitish "([1]).

On 27th May 1910, several flattened, white, silken cocoons were collected at Pusa on the upper surfaces of leaflets of *Phyllanthus emblica*, only one cocoon being found on each leaflet. The contained pupa was flattened dorso-ventrally and the leg and antenna cases projected beyond the anal extremity. Before emergence of the moth, the pupa wriggled out of one end of the cocoon to some extent. The moths emerged between 3rd and 6th June. (Pusa Insectary Cage-slip 836.)

NEPTICULA LIOCHALCA, MEYR.

Nepticula liochalca, Meyr., Exot. Micr., II, 6 (October 1916)([1]).

Bred at Pusa in July from larvæ mining in leaves of *Cyperus rotundus* (Cyperaceæ)([1]). Mr. Meyrick further remarks that a sedge is a new and unexpected foodplant for this genus.

The original description includes the following note on the larva from particulars supplied from Pusa :—" Larva yellow, transparent, shiny, head brown, somewhat bilobed ; the mine is commenced either from the top or middle of the leaf, the larva mines down for some length and then takes a turn and mines up, the second portion being exactly parallel to the first, excreta deposited in a streak all along the mine ; the larvæ left the leaves and pupated in flat, oval cocoons of golden-yellow silk ; two examples were bred."

MICROPTERYGIDÆ.

Only a single Indian species (*Neopseustis calliglauca*, Meyr.), from the Khasi Hills, is recorded, and nothing is known regarding its larval habits.

A good recent account of the group is given by Tutt (*Brit. Lep.*, I, 129-162).

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MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA

IX. APPENDIX.

BY

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Imperial Entomologist

AGRICULTURAL RESEARCH INSTITUTE, PUSA

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PREFACE

Since sending to press parts 1–8 of this volume a few additional life-histories have been worked out at Pusa. Mr. W. M. Maxwell, I.C.S., has also kindly sent me some notes on various species reared by him in Bombay, and Mrs. Drake has forwarded notes on a new species of *Antispila* from Serampore. The opportunity is taken to add these supplementary notes to the present volume in order to have all our information under one cover.

Pusa, 5th April 1920. T. BAINBRIGGE FLETCHER.

PLATE LVIII.

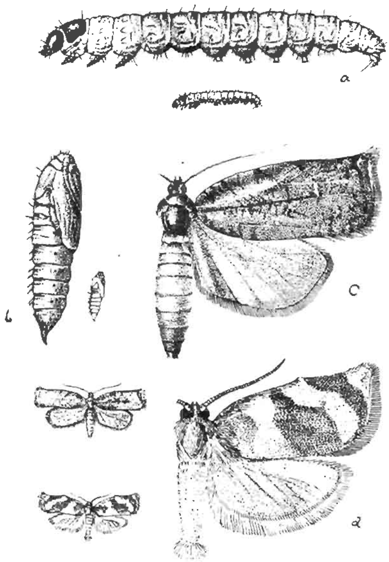

Fig. 1. *Cacoecia pomivora*:—*a*. Larva, lateral view (x4); *b*. pupa, lateral view (x4); *c*. female moth (x4); *d*, male moth (x4). The smaller figures show the natural sizes.

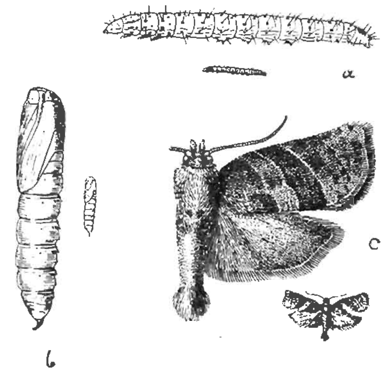

Fig. 2. *Ulodemis trigrapha*:—*a*, Larva, lateral view (x4); *b*, pupa, lateral view (x4); *c*, moth (x4). The smaller figures show the natural sizes.

LIFE-HISTORIES OF INDIAN INSECTS. MICROLEPIDOPTERA.

IX. APPENDIX.

BY

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[Received for publication on 24th April 1920.]

TORTRICIDÆ.

ADOXOPHYES MODERATANA, WLK.

Tortrix moderatana, Wlk., Cat., XXVIII, 328-329 (1863)(1).

Adoxophyes moderatana, Meyr., Cat. Tortric., p. 14 (1912)(2).

Walker originally described this species from Sarawak,(1) but perhaps in error, as Meyrick(2) only records it from India. We have it from Pollibetta in South Coorg.

Bred on 3rd January 1912 [at Karwar] from larva found in spun leaves of *Simplocos spicata*. (*Maxwell.*)

CACŒCIA POMIVORA, MEYR. MS. (PLATE LVIII, FIG. 1.)

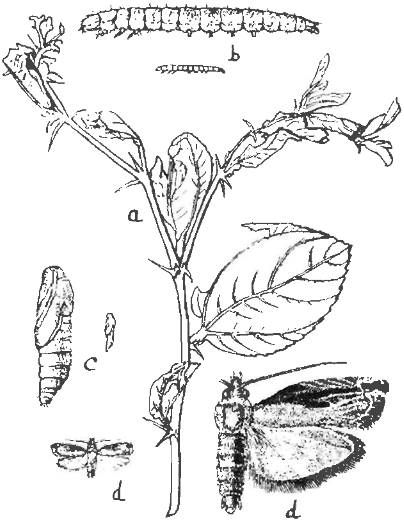
This species seems to be a local pest of apple at Ramgarh, Kumaon District, the larva generally boring into the fruit from the apical end and driving a gallery right through the core, this gallery being widened laterally into the fruit itself which ultimately begins to rot. The external end of the gallery is closed with silken threads intermixed with frass. Only one larva is found in each affected fruit. Examples of affected apples were received on 15th September 1919, through the kindness of Mr. Johnson, of Apple Garth Orchard, Ramgarh, and from the material sent moths were reared out at Pusa, between 20th September and 13th October.

The full-grown larva (Plate LVIII, fig. 1*a*) is about 18 mm. long and 2 mm. broad across mid-body, tapering slightly towards either extremity, yellowish-green or pale-yellow; head black, glossy, flattened; prothoracic shield large, black, medially divided; other segments with a couple of elongated black spots and a round, white-centred, black spot on each side; first two pairs of legs black, the metathoracic leg yellowish-brown, black apically; five pairs of slender, equally-developed prolegs concolorous with the body.

When full-fed, the larva leaves the fruit and pupates in a very thin cocoon built in any convenient crevice. The pupa (Plate LVIII, fig. 1*b*) is about 10 mm. long, tapering prominently posteriorly, brown; the second and third abdominal segments with a deep dorsal groove on their anterior margins; the succeeding segments up to the eighth have each a dark ridge in the same situation; the second to eighth abdominal segments with a double, dorsal, transverse row of posteriorly-directed spines; dorsal margin of anal segment protruded into a long cremaster provided with four recurved spines apically and two similar spines on each side, these circinate spines being entangled in the silken fibres of the cocoon. The pupal period was about eight days at Pusa. (Pusa Insectary Cage-slip 1918.)

ULODEMIS TRIGRAPHA, MEYR. (*ante*, page 40.) (PLATE LVIII, FIG. 2.)

This species was reared from a larva found boring into an apple fruit at Shillong in September 1919. The larva eats in at the flower-scar and bores a tunnel into the centre of the fruit and feeds on it. In the single case noted the larva did not penetrate into the pulp of the fruit. When full-fed, the larva emerges from the fruit and pupates in any convenient crevice. Although only a single specimen was noted, this larva is stated to be not uncommon as a borer in apple fruits at Shillong. Apparently the same species was also reared at Shillong from a larva found feeding in spun-up flowers of *Colquhounia coccinea*, webbing up the bunches of buds and flowers and eating into the sides of the flower-tubes. The larva was described as about 14 mm. long, elongated, moderately slender, whitish-green; head yellowish, with yellowish-brown markings laterally; prothoracic shield large, pale greenish-yellow edged laterally with black; legs black, rather large; prolegs (four pairs and anal claspers) rather short, whitish-green; each segment with two dorso-lateral black tubercles, on same level, conspicuous, and large perpendicular black tubercle and others (less conspicuous) below this; the tubercles emit longish white hairs. The moth from this larva emerged on 2nd October 1919.



Ancylis lutescens:—

a, Top-shoot of *Zizyphus*, showing leaves rolled and twisted by larvæ.
b. Larva, natural size and magnified (x 3½).
c. Pupa. do. do. do. do.
d, Moth. do. do. do. do.

PERONEA AGRIOMA, MEYR. MS.

Reared at Shillong in July 1918 from larva on apple. Also feeds commonly on rose at Shillong.

EUCOSMIDÆ.

ACROCLITA VIGESCENS, MEYR. (*ante*, page 44.)

This species has again been reared at Pusa from larvæ found on 2nd December 1919, on *Cordia myxa*, tying the leaves one above another, living inside, and nibbling the green tissue from the surface of the leaves.

The larva is about 10 mm. long and about 1·5 mm. across the thoracic region, rather flattened and tapering posteriorly, skin soft and rather transparent pale-yellow tinged with greenish due to abdominal contents; head rather flattened, brownish-yellow, glossy; prothorax covered with a large, glossy, brown to dark-brown shield; hairs rather short, white; spiracles minute, yellow; legs and five pairs of equally-developed prolegs pale-yellow.

Pupation takes place between the leaves in a white silken cocoon covered with black pellets of frass. The pupa is about 4·5 mm. long and 1·25 mm. across thoracic region, tapering in either direction, brown-yellow; second and following abdominal segments with an anterior dorsal transverse row of small posteriorly-directed spines; anal segment rounded posteriorly and with the transverse row of spines on its dorsal margin. The pupa wriggles out of the cocoon to some extent before the moth emerges. Moths emerged between 5th January and 3rd February 1920. (Pusa Insectary Cage-slip 1973.)

ANCYLIS GLYCYPHAGA, MEYR. (*ante*, page 45.)

Bred in January 1915 from larvæ found amongst spun leaves of *Zizyphus rotundifolia*, feeding on the lower surface of the leaf, apparently when young mining under the cuticle. Larva with head small, pale-brownish, much porrected and shiny; body with segments strongly marked, pale greenish-ochreous, with scattered short bristles. (*Maxwell*.)

The above record renders it probable that the larvæ reared at Pusa were actually feeding on *Zizyphus* leaves and not on the sugary excretion of *Phromnia*.

ANCYLIS LUTESCENS, MEYR. (*ante*, page 45.) (PLATE LIX.)

This has again been reared at Pusa from larvæ collected on 27th September 1919, rolling and eating top-shoots of *Zizyphus jujuba*, and the opportunity has been taken to add figures of the various stages which have been already described. (Pusa Insectary Cage-slip 1947.)

POLYCHROSIS ACANTHIS, MEYR. MS. (PLATE LX

Larvæ were found at Pusa on 26th November 1919, boring in stems of *Justicia gendarussa*. The larva bores at the top of the stem, which it usually enters at the axils of the leaves or branches, causing the top-shoot to wither. (Plate LX, fig. *a.*) The bored shoot breaks very easily at the place where the larva enters it. The larval tunnel usually runs along the axis of the stem, but may extend across it. Pupation takes place inside the bored stem in which the larva prepares a hole of exit for the future moth, the pupa wriggling out of the stem to some extent before the moth emerges.

The full-grown larva (Plate LX, fig. *b*) is about 8 to 10 mm. long, sub-cylindrical, moderately stout, tapering very slightly posteriorly, pale yellow slightly tinged with green; head large, shiny, dark-brown, almost black; prothoracic shield concolorous with head; legs pale-yellow tinged with grey; five pairs of equally-developed short prolegs concolorous with body.

The pupa (Plate LX, fig. *c*) is about 4·5 mm. long, yellow; head with a small anterior snout-like process; abdominal segments anteriorly with a transverse dorsal row of posteriorly-directed spines and posteriorly with a similar but rather indistinct row of much smaller spines; anal extremity rather rounded and provided with a few circinate hairs.

Moths (*Plate LX, fig. d) emerged on 8th and 15th December 1919.* (Pusa Insectary Cage-slip 1965.)

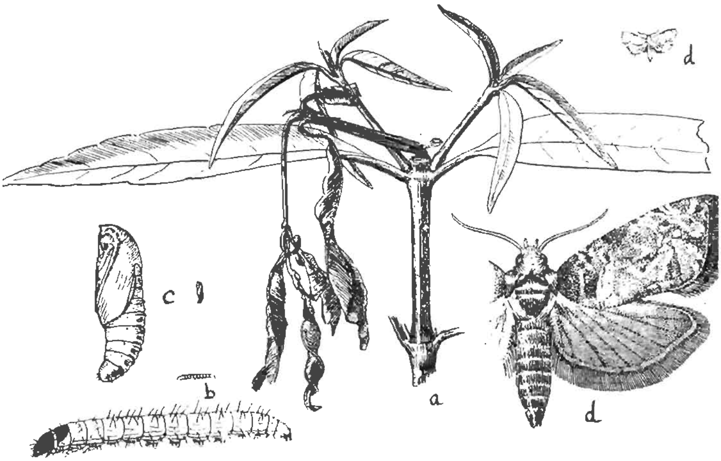
LOBESIA AEOLOPA, MEYR. (*ante*, page 54.) (PLATE LXI, FIG. 1.)

This has also been reared at Pusa from larvæ collected on 11th September 1919 living and feeding in the calyces of flowers of *gumma* (*Leucas carata*). The larva (Plate LXI, fig. 1 *a*) is about 8 mm. long and 1 mm. across the middle, tapering slightly posteriorly, green with a yellowish tinge; head shiny black; prothoracic shield black, divided medially; prothoracic legs black, others greenish-yellow.

Pupation takes place within a thinly-built cocoon hidden amongst the calyx of the flower or sometimes placed inside a tubular floret. The pupa (Plate LXI, fig. 1*b*) is about 4·5 mm. long and 1·5 across mid-body, dark rown with a greenish tinge. The moth (Plate LXI, fig. 1*c*) emerges after a pupal period of about seven days. (Pusa Insectary Cage-slip 1916.)

ARGYROPLOCE APROBOLA, MEYR. (*ante*, *page* 57.)

This has since been reared at Pusa from larvæ found on 16th October 1919, hiding among rose-petals and feeding on them; as the larvæ spin silk the petals do not fall off although they are cut basally. The larvæ are sensitive



Polychrosis acanthis:—

a. stem of *Justicia gendarussa* bored by larva, showing withered top-shoot.
b. Larva, natural size and magnified (x 7).
c, Pupa. do. do. do. do.
d, Moth, do. do. do. do.

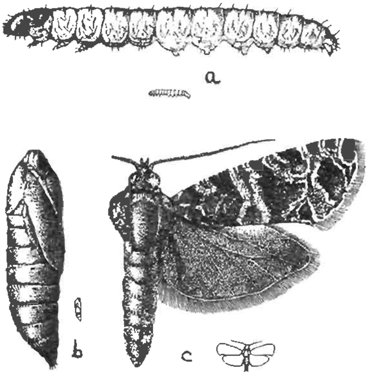


Fig. 1. *Lobesia aeolopa*:—*a*. Larva ; *b*. pupa ; *c*. moth (*female*) ; *natural* sizes and magnified (x 8).

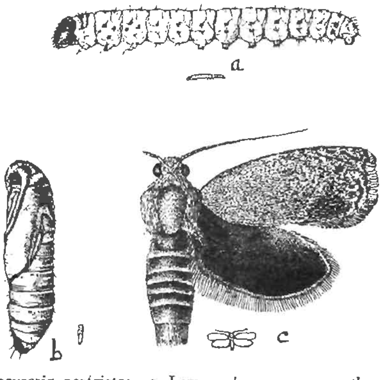


Fig. 2. *Laspeyresia perfricta*:—*a*, Larva ; *b*, pupa ; *c*, moth, natural sizes and magnified (x 8).

and jump when touched. The full-grown larva is about 20 mm. long and 2·5 mm. across the middle, tapering towards either end, flattened, pale-yellow of different shades in individual larvæ according to size and amount of food ingested, but the dorsal vessel is clearly visible in all; head flattened, glossy brown (very dark in young larvæ); prothoracic shield large, dark-brown, rather dull, and with a faint dorsal line (in young larvæ concolorous with head); first two pairs of legs dark, the third pair and five pairs of short equally-developed prolegs concolorous with the body.

Pupation takes place within rolled petals which have been lined with silk. The pupa is from 7 to 10 mm. long, cylindrical, tapering towards either extremity, brown varied with darker; abdominal segments with double dorsal rows of posteriorly-directed spines; anal segment with a number of circinate hairs which remain entangled in the fibres of the cocoon.

From these larvæ moths emerged between 29th October and 3rd November. (Pusa Insectary Cage-slip 1936.)

LASPEYRESIA CAPPARIDANA, Z. *(ante, page 63.)*

This has also been reared at Pusa from larvæ collected on 4th September 1919 feeding in top-shoots of *bagnahi* (*Capparis* sp.). These larvæ commenced to pupate on 7th September, and moths emerged between 13th and 19th September. (Pusa Insectary Cage-slip 1924.)

The specimens reared from these larvæ are very small and dark; Mr. Meyrick remarks (*in litt.*) that the species appears to vary climatically or seasonally, perhaps also by feeding on different species of *Capparis*.

LASPEYRESIA PERFRICTA, MEYR. MS. (PLATE LXI, FIG. 2.)

Larvæ were collected at Pusa on 3rd and 31st August 1919, boring into shoots of *Pongamia glabra*. The larva (Plate LXI, fig. 2*a*) is rather over 8 mm. long and 1·25 broad, pale-yellow; head brown; prothoracic shield small, light-brown, medially divided. Pupation generally takes place in a thinly built cocoon formed inside the stem within the larval tunnel. The pupa (Plate LXI, fig. 2*b*) is rather less than 5 mm. long and rather more than 1 mm. broad, yellowish-brown. From larvæ which pupated on 9th September, moths (Plate LXI; fig. 2*c*) emerged on 17th and 18th September. Moths have also been reared out in December. (Pusa Insectary Cage-slip 1914.)

PAMMENE QUERCIVORA, MEYR. MS.

Bred at Shillong on 3rd July 1918 by Y. Ramachandra Rao from larvæ feeding on leaves of *Quercus griffithii*.

GELECHIADÆ.

STEGASTA VARIANA, MEYR. (*ante*, page 83.) (PLATE LXII, FIG. 1.

This species has been reared again at Pusa from larvæ found on 26th November 1919 feeding between spun leaves of *chakaur* (*Cassia* sp.). The larva binds one leaf over another (Plate LXII, fig. 1*a*), lives between them and nibbles the green tissue.

The full-grown larva (Plate LXII, fig. 1*b*) is about 8 mm. long and 1·25 mm. broad, subcylindrical, tapering at either extremity; head smaller than prothorax, shiny black; prothorax scarlet with a glossy black or dark-brown shield; mesothorax scarlet; other segments pale greenish-yellow tinged with pink; hairs pale-yellow, arising from small black points; spiracles small, round, with a black rim enclosing a clear space; legs black, shiny; five pairs of equally-developed pale-yellow prolegs.

Pupation takes place between the spun leaves in a small white silken cocoon, the empty pupa-case being left in the cocoon on emergence of the moth.

The pupa (Plate LXII, fig. 1*c*) is about 4 mm. long and 1·3 mm. broad across thoracic region, tapering prominently posteriorly, brownish-yellow, the hinder end rounded and provided with a few radiating fine hairs. From larvæ which pupated about 1st–2nd December, moths emerged between 22nd December 1919 and 10th January 1920. (Pusa Insectary Cage-slip 1969.)

LECITHOCERA EFFERA, MEYR. (PLATE LXII, FIG. 2.)

Two larvæ were found at Pusa, on 5th November 1919, rolling and eating the leaves of *Ipomœa reptans*. Of these one was parasitized but the other pupated on 20th November, and emerged as a moth on 28th November. A few more larvæ were obtained on 26th November, and emerged between 18th December and 14th January 1920.

The larva (Plate LXII, figs. 2*b*, *c*) is about 12 mm. long and 1·5 mm. across the middle of the body which is slightly flattened and tapers towards either extremity; head red-brown, glossy, flattened; prothorax covered with a large blackish-brown shield; the intersegmental region between prothorax and mesothorax with a white collar-like band interrupted mid-dorsally; between mesothorax and metathorax there is a white band; mesothorax, metathorax and first two abdominal segments velvety black; other segments yellowish-white marked on third, fourth, sixth and seventh abdominal segments with a velvety black band which passes over the anterior part of the segment and goes down obliquely posteriorly on each side, and on the posterior part

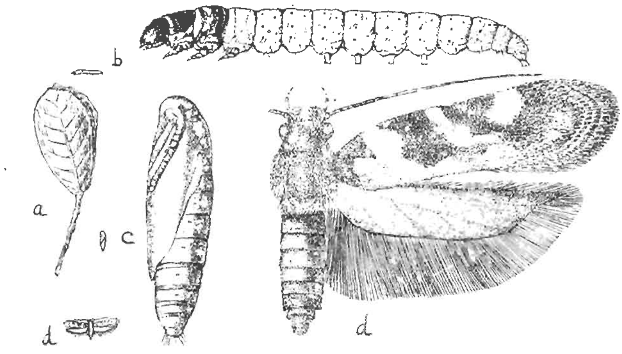


Fig. 1. *Stegasta variana*:—*a*. Leaves spun together by larva; *b*. larva; *c*. pupa; *d*. moth; natural sizes and magnified (× 12).

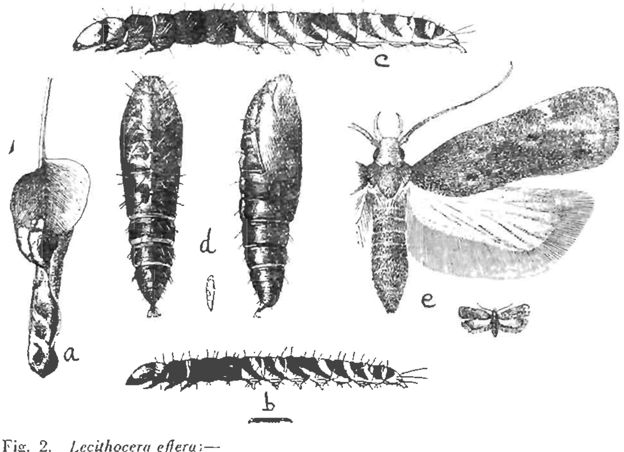


Fig. 2. *Lecithocera efflera*:—
a. Leaf rolled and eaten by larva;
b, Larva, about $\frac{3}{4}$ grown, natural size and magnified (x 7);
c. Larva, full-grown, magnified (x 7);
d, Pupa, natural size and magnified (dorsal and lateral views) (x 7);
e. Moth, natural size and magnified (x 7).

of these segments there is also a transverse black bar almost touching the arms of the band ; on the fifth abdominal segment also there is a similar band but dorsally it is obscured by a large velvety black patch ; on eighth and ninth abdominal segments there is a large black anterior dorsal patch, that on eighth segment tending to form an oblique band, and posteriorly there is also a small black dorsal patch ; tenth abdominal segment with a small black dorsal patch ; legs black, shiny ; five pairs of equally-developed pale-yellow prolegs.

Pupation takes place inside a leaf rolled longitudinally. (Pusa Insectary Cage-slip 1962.)

HELCYSTOGRAMMA LAMPROSTOMA, ZELL.

Gelechia lamprostoma, Zell., Isis, 1847, 851-852([1]).
Gelechia zulu, Wlsm., T. E. S. 1881, 261-262, t. 12, f. 30 (1881)([2]).
Anacampsis lamprostoma, Wlsm., T. E. S. 1891, 94-95 (1891)([3]) ; Stdgr.—Rebel, Cat. Lep. Pal. II, 154, No. 2848 (1901)([4]) ; Snell., Tijds. voor Ent. 1901, 88 (1901)([5]) ; Spuler, Schmett. Europ. II, 374 (1910)([6]).
Strobisia lamprostoma, Meyr., B. J., XX, 732 (1911)([7]).

Originally described from Sicily by Zeller([1]), this species has since been recorded from Spain([3]), Asia Minor([3]), Gambia([3]), Natal([2, 3]), and Java([5]), and, within our limits, from India([3]) and Yala, in South-East Ceylon([7]).

It has been reared at Pusa in November 1919 from a larva rolling a leaf of *Ipomœa reptans* and in December 1919 from a larva rolling leaves of sweet-potato.

TRICHOTAPHE PLUTELLIFORMIS, SNELL.

Ceratophora plutelliformis, Snell., Tijds. voor Ent., XLIV, 84, t. 6, f. 4([1]).
Trichotaphe plutelliformis, Meyr., B. J., XXII, 180 (1913)([2]).

Originally described from Java([1, 2]) this species has since been recorded from Australia([2]), Ceylon (Puttalam)([2]), and North Coorg.([2])

This species was reared at Pusa from larvæ collected on 3rd and 14th November 1919, on leaves of *Ipomœa reptans*. The larva folds the two blades of the leaf together, fastening the margins with silk. It is about 7 mm. long, skin soft and uniform pale-yellow ; hairs black, arising from black points ; spiracles small, round, light-brown with a narrow dark rim ; head large, black, glossy ; prothorax entirely covered by a black, glossy shield ; legs and five pairs of equally-developed prolegs concolorous with the body. Pupation takes place within a rolled leaf. Moths emerged between 19th November 1919 and 13th January 1920. (Pusa Insectary Cage-slip 1955.)

TRICHOTAPHE PSEUDOMETRA, MEYR.

Trichotaphe pseudometra, Meyr., B. J., XXII, 179 (1913)([1]).

Bred [at Karwar?] on 31st August 1913 from larva found between spun leaves, and which pupated on 24th August. (*Maxwell.*)

Originally described from North Coorg([1]).

ŒCOPHORIDÆ.

PICROTECHNA OPHIODORA, MEYR.

Picrotechna ophiodora, Meyr., Exot. Micr., I, 260 (1914)([1]).

Described from the Khasi Hills([1]).

Bred [at Karwar ?] from numerous larvæ, each living separately but so crowded as to be almost gregarious, on an unidentified shrub which was described as an erect woody jungle plant with deeply 5-palmate reticulately veined leaves with acuminate lobes, 7-nerved, alternately whorled on stem with long petioles. Each larva lives under a white web situated on one of the main nerves on either the upper surface or the under-side of the leaf. The central portion of the web is so tightly spun as to be opaque, concealing the larva. Under each web there is a round hole of escape to the other side of the leaf, and the larva emerges and feeds on both sides of the leaf, moving actively. The larva is opaque creamy to greenish, dorsal area often darker, body tapering considerably posteriorly, segments strongly marked, with rather long whitish hairs distributed as usual; head large, greenish, with red-fuscous cheeks; prothoracic plate centrally greenish, laterally red-fuscous; anal claspers prostrate. The pupa is altogether external, attached by the tail only, and lies prostrate on the under-side of the leaf; in shape it is very like that of *Tonica;* in colour pale-brown with darker-brown points and markings. Larvæ collected at Christmas 1914, emerged on 14th January 1915. (*Maxwell.*)

PORTHMOLOGA PARACLINA, MEYR. (*ante*, page 109.)

Bred in February 1916 from a pupa found on *Zizyphus rotundifolia.* The pupa was similar to that of *Picrotechna ophiodora.* (*Maxwell.*)

CRYPTOLECHIA ARVALIS, MEYR. (*ante*, page 109.)

Bred from larva found between spun leaves of *Careya arborea.* The larva has the head and prothoracic shield black and shiny, the body green, long and tapering, with a few bristles, subdorsal and spiracular lines fuscous, former rather faint, latter strongly marked in the middle of each segment and heavily marked towards the head. Pupa between same spun leaves, attached by tail only. Imago very sluggish. (*Maxwell.*)

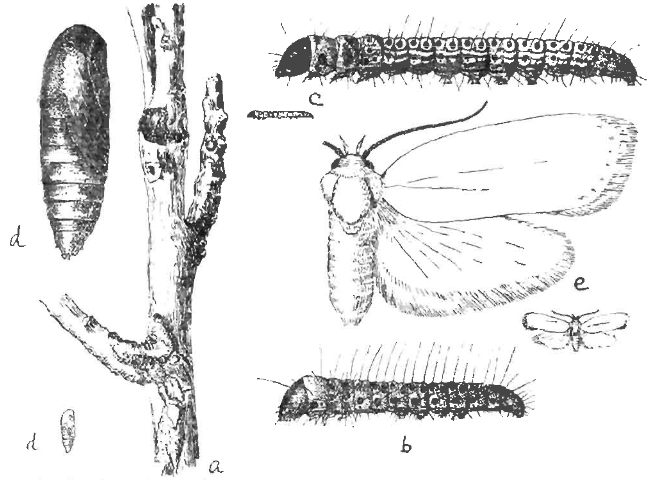


Fig. 1. *Ptochoryctis rosaria*:—
a, Apple-twig bored by larva, showing (below) tunnel covered with silken tube, and (above) silken tube removed, showing bark eaten away;
b, Larva, magnified (x 7) ;
c, Larva, full-grown, natural size and magnified (x 5) ;
d, Pupa, natural size and magnified (x 5) ;
e, Moth, natural size and magnified (x 5).

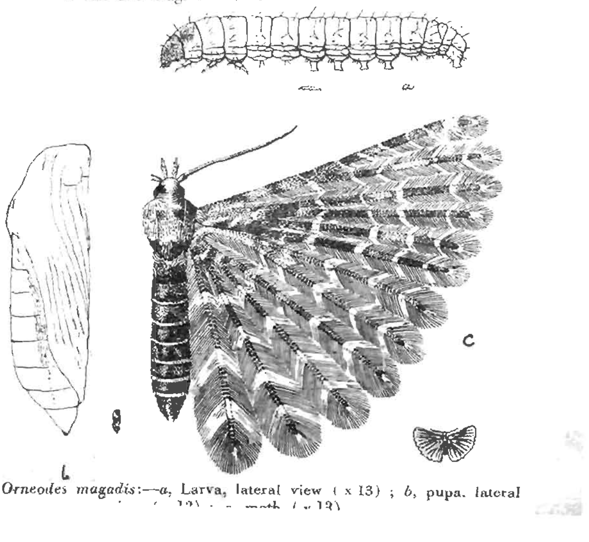


Fig. 2. *Orneodes magadis*:—*a*, Larva, lateral view (x 13) ; *b*, pupa, lateral [illegible] (x 13) ; *c*, moth (x 13).

XYLORYCTIDÆ.

PTOCHORYCTIS ROSARIA, MEYR. (PLATE LXIII FIG. 1)

Ptochoryctis rosaria, Meyr., B. J., XVII, 740 (1907)(1).

This insect, which has hitherto only been known from Bhutan(1), is a serious pest of apple at Shillong, the red larva eating into the bark of young twigs under cover of a silken gallery (Plate LXIII, fig. 1*a*). The angles formed between outgrowing twigs form a favourite place for attack by this larva, and considerable damage may be done by the stunting back of young growth. Larvæ were collected at Shillong in October 1919 and brought to Pusa, where no apple is available, and they were supplied with twigs of pear on which they fed up to the end of February 1920. One was found pupated on 5th March and emerged on 9th March.

The larva (Plate LXIII, figs. 1*b*, *c*) is about 12 mm. long and about 2 mm. broad across the head and thoracic region, cylindrical, tapering posteriorly very slightly and gradually, brick-red, with chequered whitish dorsal markings; head dark-brown or almost black, shiny; prothorax wholly covered by a brown, somewhat glossy plate; ninth and tenth abdominal segments darker, the latter with a large dark-brown somewhat glossy plate; tubercles dark-brown, shiny, with rather long white hairs; trapezoidal tubercles large and round, making the larva look spotted; spiracles small, rather oval, dark-brown, with a slit in the middle; legs black, shiny; five pairs of equally-developed rather short, pale yellow prolegs.

Pupation took place under webbed-up frass on a twig. In nature it probably occurs in the larval gallery. The pupa (Plate LXIII, fig. 1*d*) is about 9 mm. long and 2·5 mm. across the thoracic region, cylindrical, slightly and gradually tapering posteriorly, dark brown; anal segment blunt, with a pair of short spines on the dorsal surface and with a flattened wing-like projection on dorsal margin of anal extremity; anterior extremity of pupa rounded and with a roughened surface; the dorsal side of thoracic region and anterior part of abdominal area has also a roughened surface.

The moth (Plate LXIII, fig. 1*e*) is pure white, with a few antemarginal black dots on forewing. (Pusa Insectary Cage-slip 1988.)

STENOMIDÆ.

STENOMA ICHNÆA, MEYR. (*ante*, page 115.)

Bred in North Kanara in January 1912 and 1914 from larvæ found between spun leaves of *Symplocos spicata*, generally laying one leaf (alive or dead or

even fallen from another tree) on the face of another, back to face in natural position, very inconspicuous, the larva usually retiring into a cocoon-like cell spun between the two leaves with an admixture of excrement. The full-grown larva is about 14 mm. long, tapering in either direction, especially posteriorly, segments strongly marked, green tinged dorsally with reddish-fuscous. alimentary canal visible, darker green; head reddish-fuscous; prothoracic plate darker; a supra-spiracular series of black dots anteriorly on each segment, each dot emitting a longish pale bristle; a series of smaller black dots, each emitting a shorter pale bristle, situated posteriorly on each of the first four abdominal segments, on each of which segments there are thus two dots obliquely situated, the anterior dot being higher than the posterior; on last five abdominal segments traces of a third subdorsal row, more marked posteriorly, situated anteriorly on the segments; anal flap rounded, with black edges. Pupa dark, red brown, short and stout, attached by tail in the web between leaves, emitting a frequent sharp clicking sound when disturbed. The moth is very sluggish by day. Larvæ collected on 28th December 1911, emerged on 16th February 1912, and others collected at Christmas 1913, emerged on 17th January 1914. (*Maxwell.*)

ORNEODIDÆ.

ORNEODES MAGADIS, MEYR. (PLATE LXIII, FIG. 2.)

Orneodes magadis, Meyr., T.E.S. 1907, 510 (1908)(1).

Originally described from Shillong(1).

The larva (Plate LXIIf, fig. 2*a*) feeds in Shillong within the flower-buds of *Colquhounia coccinea*, but is very difficult to find as a rule within the flower-buds. If the flowers are collected, however, the larvæ sometimes emerge to pupate externally and the moths may be bred fairly readily.

The full-grown larva is about 5 mm. long, rather flattened and decidedly stout for its length, dirty yellowish-white, sometimes suffused with pink over dorsal areas except head and prothorax; head pale-yellow or yellowish-brown, mouthparts reddish or reddish-brown, sharply divided; the abdominal segments each divided into a larger anterior and a smaller posterior subsegment and also with a sort of flange along the side above level of spiracles so that the dorsal portion stands out as a ridge; the dorsal vessels (? silk glands) show as a dark green through skin of thoracic and anterior abdominal segments; prothoracic shield not conspicuous; short white hairs (only notable through a lens) on body-segments. The larva drops by a thread when disturbed, when wandering externally.

Pupation takes place within a thin white silken cocoon which is normally spun amongst the flowers of the food-plant. Pupa pale yellowish-brown. (Plate LXIII, fig. 2*b*.) The moth (Plate LXIII, fig. 2*c*) may be beaten from bushes of *Colquhounia coccinea*.

HELIOZELIDÆ.

ANTISPILA ARISTARCHA, MEYR. (*ante*, page 119.)

Bred in August 1913, at Karwar, from larvæ found on *Vitis* sp. in numerous transparent blotches formed between both cuticles. Numerous larvæ were found in each leaf and the blotches were occasionally confluent. The excrement forms a wavy line in the deserted portion of the blotch. (*Maxwell*.)

ANTISPILA ANNA, MEYR. MS.

This species has been found at Serampore by Mrs. Annie Drake who, in her letter dated 24th November 1919, wrote :—" About the middle of July, I noticed a curious wee thing like a fragment of leaf on a leaf of *Eugenia jambolana*, and on holding it up to the light could see the movements of the larva inside it. After a little over a week the moth emerged. I only found two more cocoons at that time and they had evidently been parasitized, each having a minute round hole at one side whereas the one from which the moth came had the pupal shell protruding from the top of the cocoon.......... Yesterday I found more of these interesting cocoons, five of them on leaves and three on the trunk of the tree." Some of these cocoons were sent to Pusa and from them we were able to rear out the moths. In sending a further consignment of cocoons, in her letter of 20th March 1920, Mrs. Drake wrote : " The moth appears to deposit its eggs singly at the apex of the leaves of *Eugenia jambolana*, Lam., and to select the leaves on the highest branches. On holding the leaf up to the light one can see the larva between the epidermal layers. It seems to confine itself to one side of the mid-rib and keeps to the upper end of the leaf. When ready to pupate it cuts the leaf through around itself and lowers itself by a silken thread and is borne hither and thither by the breeze till at last it alights on a leaf or a branch lower down in the tree to which it at once fastens its cocoon. The moth emerges about a week later in the day time. The pupa is protruded from the apex of the cocoon. Those that are parasitized have a minute hole in the side of the cocoon from which the Hymenopteron has emerged."

GLYPHIPTERYGIDÆ.

SIMAETHIS ORTHOGONA, MEYR. (*ante*, page 126.) (PLATE LXIV, FIG. 1.)

This has been reared again at Pusa from larvæ found on 21st August 1919, feeding on leaves and top-shoots of *sinhora* (*Streblus asper ?*). The larva (Plate LXIV, fig. 1*a*) is very active, jumping at the least touch; it is about 10 mm. long and 1 mm. across the middle, tapering slightly posteriorly; general colour whitish-blue with numerous black spots; head rather flattened, yellowish-brown.

Pupation takes place in a double cocoon which is usually spun on a leaf, the outer cocoon being of thin texture whilst the inner one, in which the pupa rests, is stiff. Pupation occurs about two days after commencing to spin up and the moth emerges after another six days. The pupa (Plate LXIV, fig. 1*b*) is about 5·5 mm. long and 1·75 mm. across the thorax, brown-yellow. The moths (Plate LXIV, fig. 1*c*) from these larvæ emerged between 3rd and 6th September. (Pusa Insectary Cage-slip 1915.)

CHOREUTIS BJERKANDRELLA, THNB. (*ante*, page 128.) (PLATE LXIV, FIG. 2.)

This has also been reared at Pusa from larvæ found on 22nd October 1919, webbing the top-leaves of *mundi* (*Sphæranthus indicus*), living hidden inside the webbed-up leaves and nibbling their surfaces.

The full-grown larva (Plate LXIV, fig. 2*a*) was described as about 7 mm. long and slightly more than 1 mm. broad across the middle of the body which tapers slightly towards either end, skin glossy, soft and transparent, pale yellow, showing a slight green tinge when food is taken; head rather glossy; dorsal vessel faintly visible; short, yellow hairs arising from black points; spiracles small, round, with a brown rim; five pairs of equally-developed, slender, rod-like prolegs.

Pupation takes place on the plant in thin white silken cocoons formed amongst the leaves. The pupa (Plate LXIV, fig. 2*b*) is about 4·5 mm. long and 1·3 mm. across the thoracic region, yellow-brown; capital extremity blunt; anal extremity tapering; anal segment dorsally with an anteriorly-curved horn-like spine. When disturbed, the pupa does not wriggle but moves the anal extremity rapidly up and down. The pupal period is about five days. Moths (Plate LXIV, fig. 2*c*) emerged from these larvæ between 28th October and 19th November. (Pusa Insectary Cage-slip 1938.)

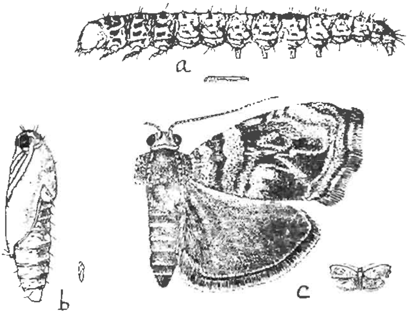


Fig. 1. *Simaethis orthogona*:—*a*, Larva ; *b*. pupa ; *c*, moth, natural sizes and magnified (x 7).

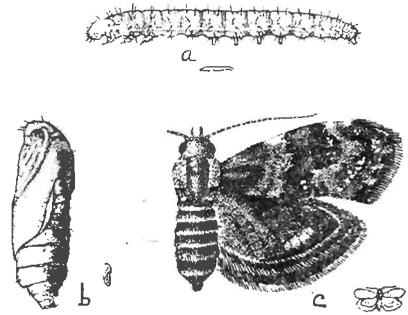


Fig. 2. *Choreutis bjerkandrella*:—*a*, Larva ; *b*, pupa ; *c*, moth ; natural sizes and magnified (x 8).

GRACILLARIADÆ.

LITHOCOLLETIS VIRGULATA, MEYR. *(ante, page 138.)*

Bred [at Karwar] in January and May 1916 from larvæ found in a more or less regular oval or roundish blotch, measuring about 15 by 10 mm., formed on the upper surface of a leaf of *Butea frondosa*. The cuticle over the blotch becomes tightly stretched and white, often puckering the leaf below it; a small discoloured oval patch is often visible on the white stretched cuticle, probably representing the early location of the larva. Pupation takes within the blotch and in the case of one specimen the pupa was observed to be tightly enclosed in a fine white spindle-shaped cocoon resting on the leaf-surface, but in other cases it seemed to be in a fine, light-spun web. The pupa is protruded on emergence, puncturing the cuticle of the blotch by means of a sharp diamond-shaped rostrum on its head; the position of the pupa on emergence is supine. One specimen was noticed to emerge at about 10 A.M. The moth sits with the head depressed, touching the resting surface, and the tail elevated; this was observed in every specimen bred. *(Maxwell.)*

Larvæ were collected at Pusa on 9th June 1919, mining blotches in the upper surface of leaves of *Pongamia glabra*. The mines were of various shapes and sizes, one being almost oval and measuring 10 by 9 mm., another being elongated and measuring 19 by 11 mm. Pupation took place inside the larval mines and the pupæ pierced through the membranous covering of the mine and wriggled out to some extent before emergence of the moths, the empty pupa-cases being left sticking out of the mines. Moths emerged on 16th June. (Pusa Insectary Cage-slip 1907.)

LITHOCOLLETIS INCURVATA, MEYR. *(ante, page 141.)*

Bred at Karwar in August 1913 from larva mining leaf of "*karvi*" (*Strobilanthes*), forming a small blotch filling the space between two veins of the leaf, apparently between the two cuticles. The blotch is dilated, concealing its inhabitant. Pupation takes place internally, at one end of the larval blotch. The imago rests with its head down and tail elevated. *(Maxwell.)*

ACROCERCOPS ORDINATELLA, MEYR. *(ante, page 146.)*

Bred in North Kanara in July and August 1913 from larvæ on *Alseodaphne semecarpifolia* and probably other species of Lauraceæ. The egg is almost invariably laid near the mid-rib of the leaf and the young larva proceeds by a fine gallery to the blotch which it inhabits for the rest of its life. The blotch is rather regular in shape, below the upper cuticle of the leaf which has a tightly stretched appearance, the excrement being gathered at the sides of the blotch.

Several blotches are found on one leaf and these are usually occupied singly but sometimes coalesce. The larva is cylindrical with the segments rather strongly marked, orange with a tinge of crimson, the alimentary canal visible, red. When disturbed in its blotch, the larva sometimes oscillates its head and anterior segments rapidly. The cocoon is orange-coloured and is occasionally formed within the blotch. The pupal period is six to eight days. The imago is very sluggish in the day time. (*Maxwell.*)

ACROCERCOPS PHÆOSPORA, MEYR. (*ante*, page 147.)

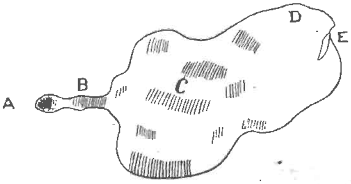
Bred in August 1914 and May 1916 at Belgaum from larvæ found in large elongate, opaque galleries in leaves of *Eugenia jambolana*, both sides of the leaves appearing swollen. The egg is laid at one side of the mid-rib on the under-surface of the leaf. The young larva mines in a single gallery along the mid-rib towards the base for about the length of the final blotch, then returns along the mid-rib for a short distance before striking across the leaf in a single gallery to the side of its blotch, and then proceeds back along the leaf parallel to the original gallery. The orange-coloured cocoon is found exposed. (*Maxwell.*)

ACROCERCOPS LYSIBATHRA, MEYR. (*ante*, page 152).

Bred [at Dharwar ?] between 31st December 1915, and 4th January 1916, from reddish larvæ mining a rather small irregular blotch on leaves of *Cordia*; the excrement following a line close to the margin of the blotch. The cocoon rather large, buff-coloured. (*Maxwell.*)

ACROCERCOPS USTULATELLA, STT. (*ante*, page 156).

Bred [? in North Kanara] from larvæ found in large numbers on leaves of *Diospyros embryopteris*, the larvæ occupying isolated blotches on both surfaces of the leaf, the blotches becoming confluent in some cases. The appearance of the blotch is shown in the text-figure, where A represents the discoloured



Larval mine of *Acrocercops ustulatella.*
(From a sketch by Mr. Maxwell.)

patch where the egg was laid, B the slender gallery, filled with the excrement of the young larva, leading to the main blotch, C the main blotch, irregular, balloon-shaped, with the larval excrement gathered in scattered heaps, D the remainder of the blotch, void of excrement, transparent, and E the larva feeding. (*Maxwell.*)

ACROCERCOPS BIFRENIS, MEYR. (*ante*, page 157.)

Bred at Khanapur, Belgaum, between 21st and 25th February 1915, from larvæ found very plentifully in leaves of more than one unidentified food-plant; one of these food-plants was described as having the leaves alternate, simple, smooth, acuminate, with opposite veins 4 to 6 or 8. The larval blotches were irregularly shaped, becoming confluent with other blotches in the same leaf, the whole of which is eventually left covered with the silvery cuticle only, the leaf underneath being discoloured with dry excrement, which is chiefly gathered around the edge of the blotches. Each blotch has an irregularly roundish tear in the cuticle covering it whilst still inhabited by the larva. The young larva is bright red, much tapering towards the tail; when full-fed it is bright crimson, cylindrical. The orange-coloured pupa is found in an orange cocoon formed on the surface of the leaf. The pupal period is about seven to eleven days in February. The imago quivers on its legs like *A. vanula*. (*Maxwell.*)

ACROCERCOPS CRYSTALLOPA, MEYR. (*ante*, page 157.)

Bred in July 1913 and also in 1915 at Karwar from larvæ found on *Memecylon edule* and *M. amplexicaule* in regular oval or sub-circular blister-like blotches formed under the upper cuticle of the leaf by continuously mining around the edge of the blotch. The larva has a very large dilated head, the body cylindrical with lateral prominences from which protrude single rather long hairs. The pupa is found inside the larval blotch and protrudes through the leaf-cuticle on emergence. The moth sits almost erect on its tail with the long antennæ held outwards and (relatively to the body) downwards, vibrating so rapidly as to be nearly invisible except towards the base. (*Maxwell.*)

ACROCERCOPS DIATONICA, MEYR. (*ante*, page 158.)

Bred in North Kanara from larvæ, sometimes found singly but often in numbers, under the upper cuticle of an unidentified herbaceous plant. The cuticle forms a tight blister over the whole surface of the leaf, and inside this blister the larva lives and feeds on the leaf which it ultimately clears, leaving only the tip and the cuticle. Pupation takes place in an oval cocoon which

turns yellowish after construction and which is formed under the blister, *i.e.* on the under-surface of the leaf-cuticle, but is apparently sometimes attached to the leaf also, especially to the mid-rib. (*Maxwell.*)

ACROCERCOPS EXTENUATA, MEYR. (*ante*, page 158.)

Bred at Karwar on 29th July 1913 from larvæ found on 16th July in blotches on underside of leaf of "*taosin*" creeper. The blotches were bounded by the main veins of the leaf, several larvæ being thus contained in one leaf in separate compartments. (*Maxwell.*)

ACROCERCOPS PHAROPEDA, MEYR. (*ante*, page 159.)

Bred at Karwar on 25th July 1913, from a larva in a rather small regular semi-transparent blotch resembling that of *A. ordinatella* except that the excrement is gathered in a heap in the middle of the blotch. The larva when disturbed oscillates anteriorly like that of *A. ordinatella*. Pupation took place on 16th July, in a brownish-yellow cocoon formed on the surface of the leaf. (*Maxwell.*)

ACROCERCOPS SCRIPTULATA, MEYR. (*ante*, page 159.)

Bred at Karwar on 28th July 1913 from cocoons found scattered about on the surfaces of a variety of leaves in the neighbourhood of *Terminalia paniculata*, which may be the food-plant. The cocoons, which are unusually large, irregularly elongate-oval, semi-transparent, white, were found at considerable distances from one another, indicating a wandering habit on the part of the larva prior to pupation. (*Maxwell.*)

ACROCERCOPS CIVICA, MEYR.

Acrocercops civica, Meyr., B. J., XXIII, 119 (1914)(1).

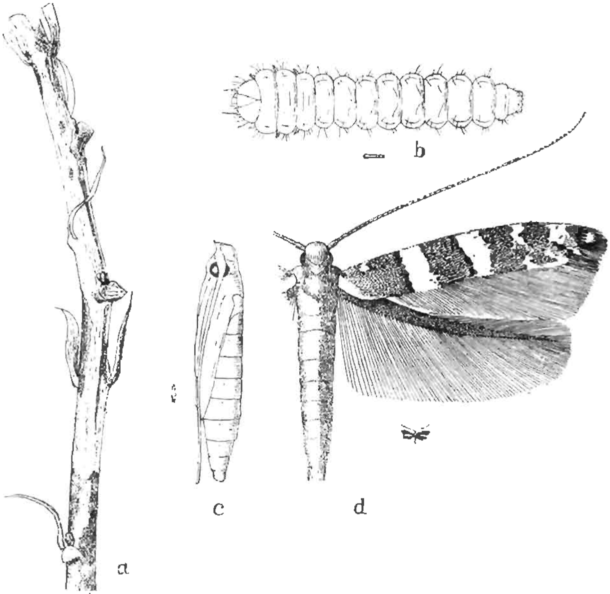
Described from Karwar(1).

Bred in 1911 and in July 1913 [at Karwar] from pink or bright-red larvæ, mining blotches in leaf of cinnamon. Many larvæ were found in each leaf, apparently exceeding the capacity of the leaf for food. In another case larvæ were found in small, distinct, roundish blotches on both surfaces of the leaf, but especially on the upper side. The larval excrement is gathered into heaps in the middle of the blotches. The orange pupa is found in an orange-coloured or creamy cocoon. (*Maxwell.*)

ACROCERCOPS ZYGONOMA, MEYR. MS. (PLATE LXV.)

Acrocercops sp., Annual Rept. Impl. Entom. 1918-19, p. 87, t. 7 (1919)(1).

The larva of this species was found at Pusa on 12th September 1918, mining under the epidermal layer of the bark of a young cotton plant.



Acrocercops zygonoma:—

a, Cotton branch attacked by larva; *b*, Larva, dorsal view, natural size and magnified;

c, Pupa, natural size and magnified; *d*, Moth, natural size and magnified.

Extensive mines are formed, covering the greater portion of the stem and some of the petioles of the leaves. As a result a thin somewhat transparent whitish paper-like membrane is formed, under the shelter of which the larva is visible. (Plate LXV, fig. *a*.)

The larva (Plate LXV, fig. *b*) is about 5 mm. long, rather flattened, about 0·7 mm. across the thoracic region, thence tapering slightly posteriorly, last two segments much narrower, segments clearly marked, uniform yellow; head flattened, smaller than prothorax into which it is partially retractile; legs and very short prolegs uniform yellow.

When full-fed the larva leaves its mine and forms a circular paper-like cover in a corner or depression on a stem or leaf and pupates in this cocoon, each larva forming a separate cocoon for itself. Moths (Plate LXV, fig. *d*) emerged on 20th and 21st September 1918. (Pusa Insectary Cage-slip 1852.)

ACROCERCOPS MALICOLA, MEYR. MS.

Bred at Shillong in June 1918, by Y. Ramachandra Rao from larvæ feeding on bark of apple.

EPERMENIADÆ.

EPIMARPTIS PHILOCOMA, MEYR. (*ante*, page 169.)

Bred [at Karwar ?] from larvæ found plentifully on leaves of *Butea frondosa* and *Xylia dolabriformis*. The larva is reddish-brown, prothoracic plate rather darker, the body-segments with dark spots, emitting hairs, each surrounded by a lighter ring. It leaves in a dirty-looking whitish and roundish web on the upper surface of the leaf. The web always adjoins a main vein and is kept off the surface of the leaf by five or six slender columns of excrement spun with silk, rendering the larva invisible. The excrement is also scattered on the outer surface of the web, giving it a rusty appearance, the rustiness being more marked in the case of webs formed on leaves of *Xylia dolabriformis*. Immediately opposite the upper web there is a similarly constructed web of much smaller size on the under-surface of the leaf, connected with the upper web by a small hole of escape through which the larva dodges with great agility when disturbed in either abode. Pupation takes place in a creamy spindle-shaped cocoon about 6 mm. long and pointed at both ends, often spun between two leaves, but sometimes exposed on leaf surface. In 1911 a specimen was bred from a cocoon which was separate, close to mid-rib, oval, resembling a birds-dropping. From larvæ which pupated in December 1915 the first moth emerged on 8th April 1916, one day after the first rain. The moth is very sluggish at night and appears to be diurnal. (*Maxwell*.)

LYONETIADÆ.

PHYLLOCNISTIS CHRYSOPHTHALMA, MEYR. (*ante*, page 171.)

Bred in July and August 1913, in North Kanara, from larva mining an elongate wandering blotch in the underside of a leaf of cinnamon, the course of the larva being marked by the excrement which forms a wavy, continuous, fine dark line. Pupation takes place inside the larval mine at the extremity of the blotch, the leaf being puckered here sharply. The pupal period is about eight days. (*Maxwell.*)

PHYLLOCNISTIS CIRRHOPHANES, MEYR. (*ante*, page 171.)

Bred in July 1913, in North Kanara, from larva found mining beneath upper cuticle of leaf of *Alseodaphne semecarpifolia.* The egg is laid near the edge of the leaf, from which the young larva proceeds at first in a spiral and afterwards in an undulating gallery, always confined to the extreme edge of the leaf, producing a blackish discoloration. When full-fed, the larva mines around the extreme edge of the leaf in a single gallery, finally pupating below the cuticle under a drawn-in edge of the leaf. The larva is flattened, shiny, tapering posteriorly, segments strongly marked, yellowish-green, last three segments more transparent; head small, black; prothoracic shield narrowed anteriorly, semi-transparent; first seven abdominal segments with a spiracular prominence ending in a bristle; anal claspers long, transparent, prostrate, divergent. The larva of this species is frequently noticed associated with that of *Acrocercops civica* in the same leaf, although the food-plant is common; in fact, the two are usually bred together. (*Maxwell.*)

PHYLLOCNISTIS CITRELLA, STT. (*ante*, page 171.)

Larva mining blotches in cinnamon and *Alseodaphne semecarpifolia.* When ready to pupate the larva works around in a gallery by the edge of the leaf and pupates internally under the turned-over edge. The larva is often found in conjunction with that of *Acrocercops civica*, sharing the same leaf. (*Maxwell.*)

The pupal cell is often found occupied by a Mite which apparently attacks and destroys the full-fed larva and newly-formed pupa.

PHYLLOCNISTIS HABROCHROA, MEYR. (*ante*, page 172.)

Bred in North Kanara in August 1913 and January 1915 from larva mining an irregularly wandering gallery in leaves of an unidentified plant locally called "*cheli*"; also found in a second unidentified leaf, which is

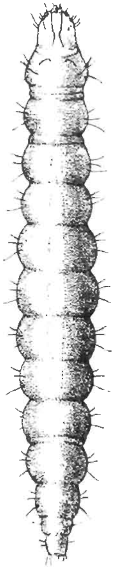


Fig. 1. Full-grown larva, dorsal view. (x 26).

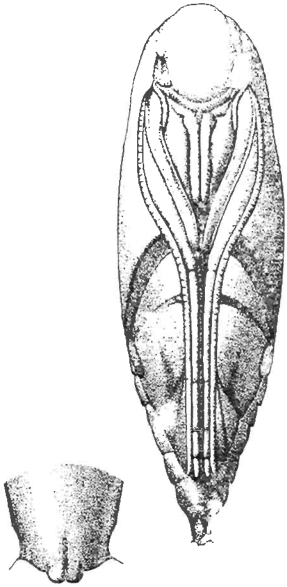


Fig. 2. Pupa of male (x 44) ; also more enlarged view of anal portion (x 133).

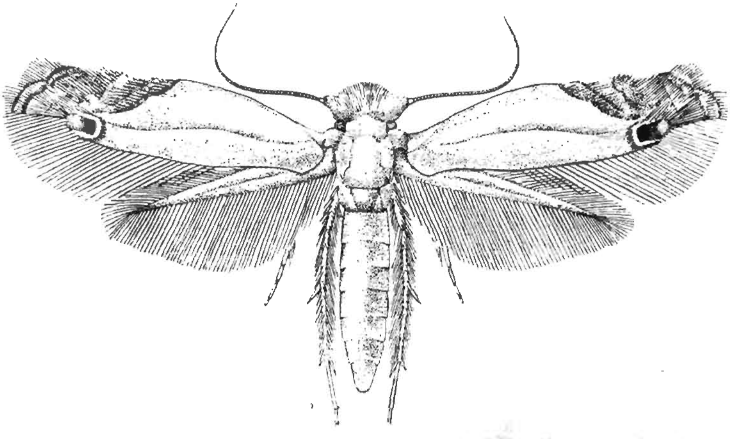
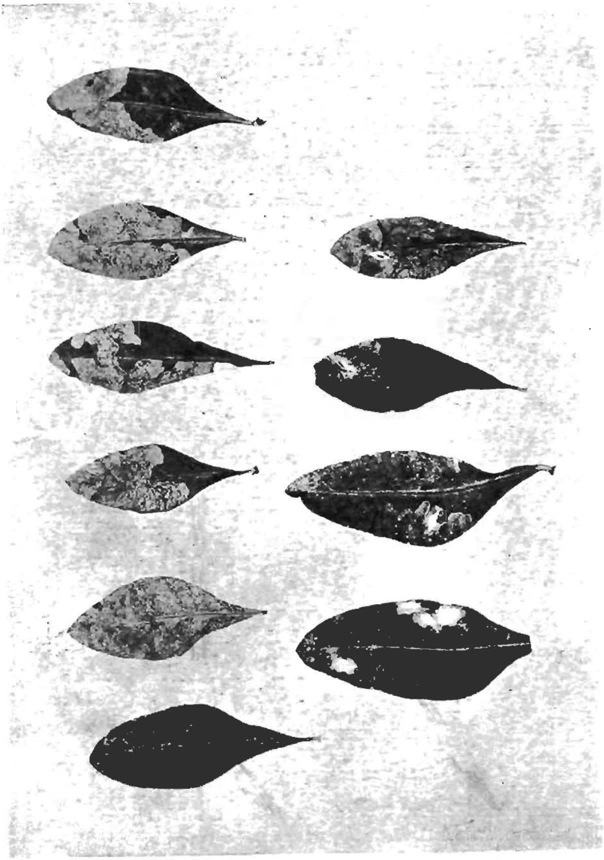


Fig. 3. *Crobylophora daricella.* Moth (x 30).

PLATE LXVII



Leaves of *Plumbogo capensis* mined by larvæ of *Crobylophora daricella.* Cocoons are also seen on exterior of leaves. *Pusa.* 3 *July,* 1919.

glandular and has a red petiole and mid-rib. Pupation takes place in a cocoon connected with gallery and formed in a tightly puckered fold in the leaf or under a tightly bent-over edge of the leaf. (*Maxwell.*)

PHYLLOCNISTIS SYNGLYPTA, MEYR. (*ante*, page 173.)

Bred [at Dharwar] in January and August 1916 from regular *Phyllocnistis* type of galleries on upper surface of leaves of a small shrub, probably a species of *Capparis*, which was described as having leaves whorled with a pair of thorns in axils, thorns straight when young but recurved when older, stems and leaves pubescent, leaves bluntly ovate, margin entire, reticulately veined, pedicel ¼ inch long. The larva, which is light-green, can be seen distinctly at the end of its gallery, its course being shown by a thin dark line of excrement which runs down the middle of the gallery, leaving a white margin on either side. Pupation takes place within a folded-over edge of the leaf at the end of the gallery, the pupa being protruded on emergence of the moth. (*Maxwell.*)

PHYLLOCNISTIS HAGNOPA, MEYR. MS.

This species was reared at Coimbatore in July 1917 from larvæ mining in leaves of *Ailanthus excelsa.* The mine is figured in *South Indian Insects* (figure 338 (1) on page 462).

CROBYLOPHORA DARICELLA, MEYR. (*ante*, page 174.) (PLATES LXVI, LXVII.)

This species was found abundantly at Pusa in June, July and December 1919 by Mr. C. S. Misra, from whose notes the following account is taken. The egg is laid irregularly on the upper surface of the apex of a leaf of *Plumbago*, the largest number found on one leaf being ten. The egg is flattened, oval, dirty-white. The larva at first makes an elongate gallery which is afterwards developed into a rounded blotch, the frass being scattered irregularly within the mine. Several larvæ may mine in one leaf. The larva is about 3·5 mm. long, pale yellow, head rather elongated, pale-brown, body-segments broad, flattened, distinct. When full-fed it emerges from the mine and pupates on the surface of a leaf under cover of a silken cocoon, two cocoons being united together at times.

BUCCULATRIX UNIVOCA, MEYR. (PLATE LXVIII.)

Bucculatrix univoca, Meyr., Exot. Micr., II, 185 (1918)[1].

Described from Pusa[1].

This has been reared at Pusa from larvæ found on 14th October 1919, mining leaves of *kalmi* (*Ipomœa reptans*) (Plate LXVIII, fig. *a*). After some time, however, the larvæ emerged from their mines and formed a sort

of transparent flat yellowish silken cocoon-like covering on the surface of leaf or stem and rested in a coiled posture inside this cell (Plate LXVIII, fig. *b*) for about two days, after which they underwent a moult and emerged again. This resting stage larva (Plate LXVIII, fig. *c*) is about 4·25 mm. long and about 0·5 mm. broad, cylindrical, with distinct segments, uniform yellow, smooth, with five pairs of equally developed prolegs. After moulting on completion of the resting-stage, however, the appearance and colour are quite changed, nor does it mine the leaf any longer but feeds openly on the leaf, nibbling the tissue. At this stage the larva (Plate LXVIII, fig. *d*) has a pale yellow head which is smaller than the prothorax and partly retractile into it ; the general colour is light yellowish-brown, the dorso-lateral regions dark-grey ; on all segments the tubercles are rounded protuberances each surmounted by a short yellowish hair ; legs and five pairs of equally-developed prolegs pale yellow. In this stage the larva grows to its full length of about 6 mm., and when full-fed it forms anywhere on the leaf or stem an elongated brown longitudinally-ribbed cocoon (Plate LXVIII, figs. *e, f*) which is fixed to the resting surface throughout its length. Pupation takes place inside this cocoon, the pupa (Plate LXVIII, fig. *g*) being about 3·5 mm. long by 0·75 mm. broad across the thoracic region, yellowish-grey ; the head end with a short pointed process ; the spiracles slightly protuberant ; the anal extremity blunt, with a short outwardly-directed pointed lateral process on each side. The pupa wriggles out through one end of the cocoon before emergence of the moth (Plate LXVIII, fig. *h*), which takes place about twelve days after spinning up. From these larvæ, moths emerged between 28th October and 11th December. (Pusa Insectary Cage-slip 1952.)

OPOGONA XANTHOCRITA, MEYR.

Opogona xanthocrita, Meyr., B. J., XXI, 111 (Oct. 1911)(1).

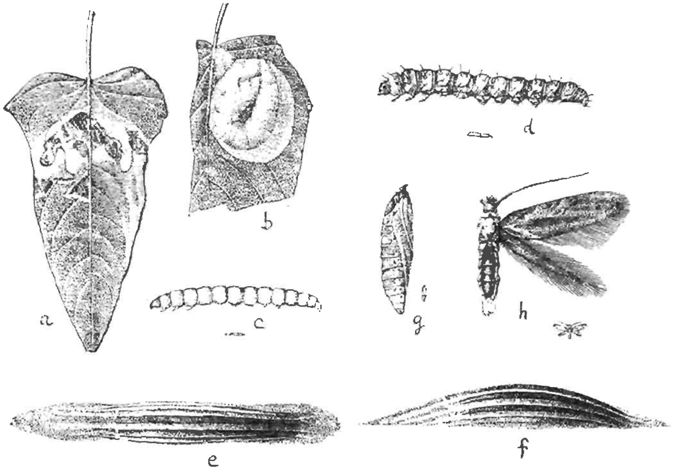
Described from the Nilgiris (3,500 feet) and North Coorg(1). It has been reared in April 1918 by Mr. K. Kunhi Kannan from imported sugarcane in Mysore State. It has also been bred from dead wood by Mr. Beeson.

TISCHERIA HESTIAS, MEYR.

Tischeria hestias, Meyr., Exot. Micr., I, 354 (1915)(1).

Described from Karwar(1).

Bred [in North Kanara] in August 1913 from a larva mining squarish blotch occupying space between two veins of a leaf of " *Kewan* " (*Helicteres isora*), no excrement being visible in the mine. Pupation takes place within the blotch, the pupa being protruded on emergence of the moth. (*Maxwell.*)



Bucculatrix univoca:—

a. Leaf of Kalmi (*Ipomoea reptans*) mined by young larva :

b. Young larva resting for moult in a silken covering after coming out of the mine;

c. Larva (*b*) shown separately, natural size and magnified (x 8) :

d. Full-grown larva, natural size and magnified (x 8) :

e. f. Cocoon. Dorsal (*e*) and side (*f*) views, magnified (x 8) ;

g. Pupa, natural size and magnified (x 8) :

h. Moth, natural size and magnified (x 8).

TINEIDÆ.

ASYNDETAULA VAGULA, MEYR.

Asyndetaula vagula, Meyr., Exot. Micr., II, 262 (November 1919)(1).

"Assam, Shillong, September (*Fletcher*). Taken flying commonly by day over a mossy bank, apparently attached to the moss, on which the larva probably feeds"(1).

INCERTÆ SEDIS.

CRYPTOLOGA NYSTALEA.

Bred in September 1913 [at Karwar] from larvæ mining blotches beneath upper cuticle of leaf of "*Karanj*," giving the leaf a silvery appearance on the upperside. Pupa generally in turned-over edge of leaf, or puckering the leaf elsewhere. (*Maxwell.*)

This species is unknown to me and the names quoted by Mr. Maxwell are presumably manuscript ones given by Mr. Meyrick but as yet unpublished.

Note.—The following species referred to in this Memoir under manuscript names, have recently been described by Mr. Meyrick in Part II of Volume II of *Exotic Microlepidoptera* (October 1920).

Page 33. *Meridarchis reprobata*, *Exot. Micr.*, II, p. 338.
,, 39. *Cacœcia pensilis* (*l.c.*, pp. 339-340) and *C. isocyrta* (*l.c.*, p. 34).
,, 41. *Acroclita vigescens*, *l.c.*, p. 343.
,, 50. *Eucosma conciliata*, *l.c.*, p. 345.
,, 53. *Polychrosis fetialis*, *l.c.*, p. 346.
,, 58. *Argyroploce cenchropis*, *l.c.*, p. 349.
,, 64. *Laspeyresia malesana*, *l.c.*, p. 352.
,, 197. *Cacœcia pomivora*, *l.c.*, pp. 340-341.
,, 199. *Peronea agrioma*, *l.c.*, p. 342.
,, 200. *Polychrosis acanthis*, *l.c.*, p. 348.
,, 201. *Pammene quercivora*, *l.c.*, p. 351.
,, 201. *Laspeyresia perfricta*, *l.c.*, p. 352.

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All species are indexed under both their generic and specific names, but page references are only given under the former.

All names *in italics* are treated as synonyms and page references are given under the corresponding generic or specific names in roman type.

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